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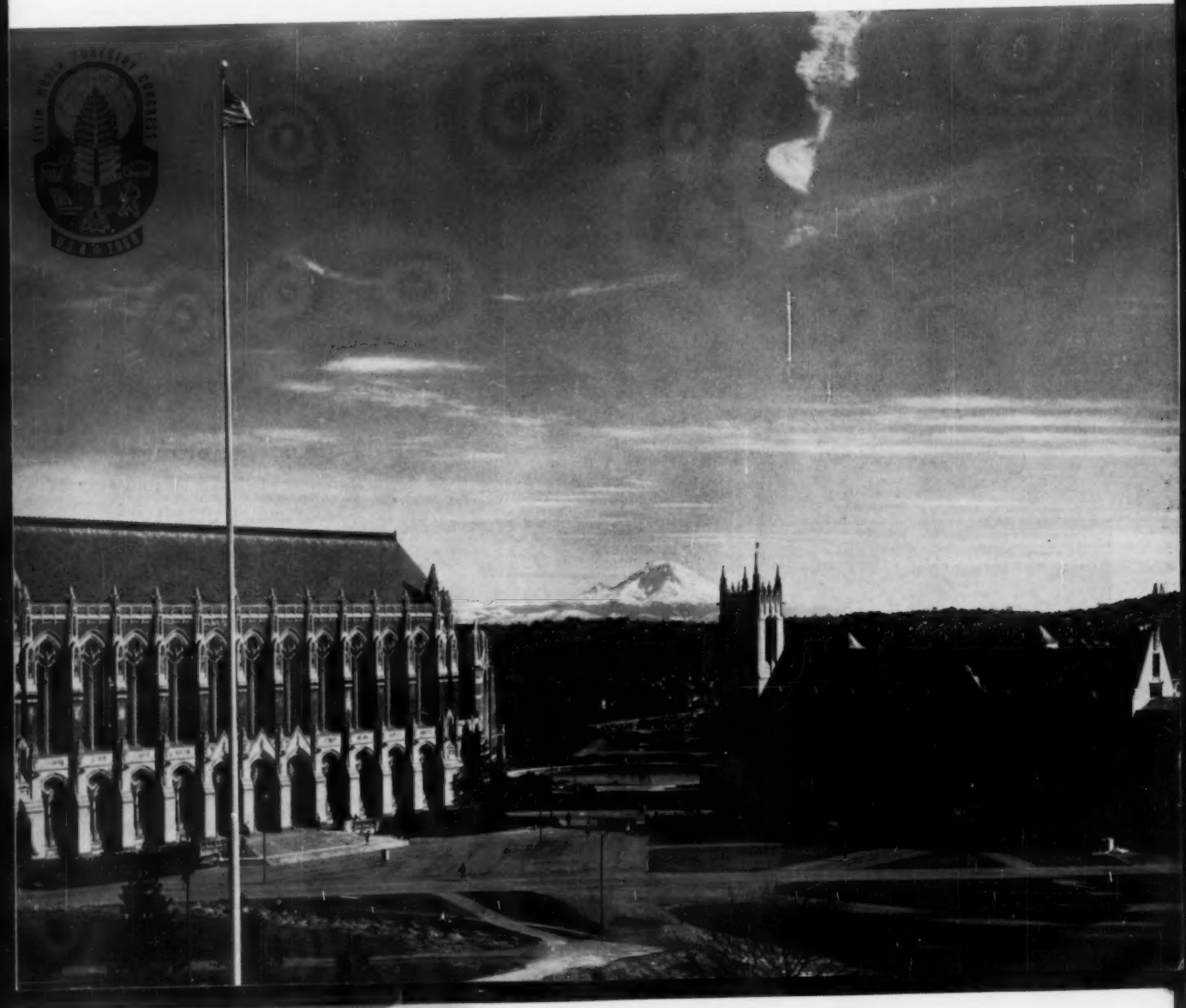

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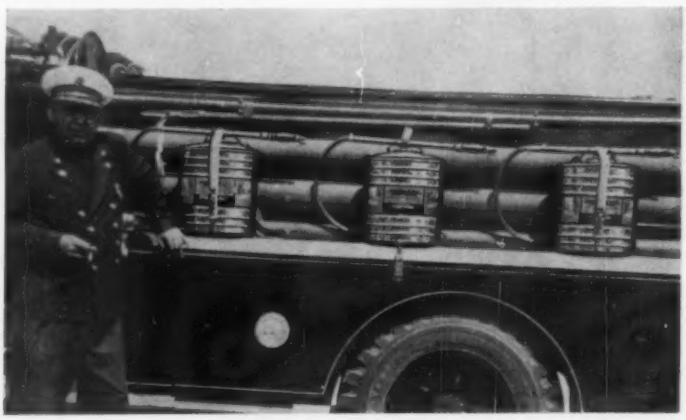

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Journal of Forestry

Official Organ of the Society of American Foresters

Welcome to the United States

Charles A. Connaughton, President
Society of American Foresters

THE Society of American Foresters and the forestry profession cordially welcome the delegates to the Fifth World Forestry Congress.

As is well known, the main purpose of the Congress is to provide for the exchange of professional and technical information, and to promote international cooperation in the scientific development and wise utilization of the world's forest resources. But the Congress provides another opportunity quite as important as the former. This is the opportunity for personal associations among professional foresters and forest industries leaders.

Never before has the United States been host to so large and diversified an assembly of foresters and forest industry representatives. Together we possess the scientific keys that can unlock the earth's forest wealth for the benefit of mankind. All of us have something to teach and something to learn about the ways to solve our forest resource problems. Let us go about it in the spirit of friendliness and good will.

For international cooperation depends not only on the free exchange of scientific knowledge. It depends quite as much on people getting to know each other and understanding each other.

To our colleagues from foreign lands, we extend a warm handclasp, and hope that they will find their visit personally gratifying and professionally rewarding.

La Société des Forestiers Américains et les techniciens de la sylviculture souhaitent une cordiale bienvenue aux délégués du Cinquième Congrès Forestier Mondial.

Comme nous le savons tous, l'objectif principal du Congrès consiste à assurer des échanges de renseignements d'ordre professionnel et technique et à favoriser la coopération internationale dans le domaine de l'aménagement scientifique des ressources forestières mondiales et de leur utilisation rationnelle. Mais le Congrès présente d'autres possibilités tout aussi importantes. Il permet aux techniciens de la forêt et aux chefs des industries forestières de se recontrer et d'apprendre à se mieux connaître.

C'est la première fois que les Etats-Unis ont l'occasion de recevoir un groupe aussi éminent et aussi varié de forestiers et de représentants des industries forestières. Ensemble, nous possédons les connaissances scientifiques qui nous permettront d'exploiter les richesses des forêts mondiales pour le plus grand bien de l'humanité. Chacun de nous a quelque chose à enseigner et aussi à apprendre lorsqu'il s'agit de résoudre les problèmes de la forêt. Faisons donc preuve d'esprit de solidarité et de bonne volonté.

En effet, la coopération internationale ne dépend pas seulement de la libre circulation des connaissances scientifiques, elle dépend tout autant d'une meilleure compréhension entre les peuples.

A nos collègues de l'étranger nous serrons chaleureusement la main; nous espérons que leur visite parmi nous se révélera à la fois utile et agréable.

La Sociedad de Silvicultores Norteamericanos y los profesionistas forestales se complacen en extender la más cordial bienvenida a los Delegados al Quinto Congreso Mundial de Silvicultura.

El objeto principal de la reunión del Congreso es, como es bien sabido, ofrecer una oportunidad para canjear información profesional y técnica, así como para fomentar la colaboración internacional para el desarrollo científico y el aprovechamiento juicioso de las riquezas forestales mundiales. El Congreso brinda, a la vez, otra oportunidad no menos importante que la anterior, es decir, la oportunidad para entablar relaciones personales de amistad entre los silvicultores profesionales y los dirigentes de las industrias forestales.

Esta es la primera vez que los Estados Unidos extienden su bienvenida a un grupo tan numeroso y distinguido de representantes de la industria forestal. En conjunto, poseemos la clave científica para dar libre acceso a la riqueza forestal del mundo en beneficio de la humanidad. Todos nosotros tenemos algo que enseñar y algo que aprender en cuanto a los medios adecuados para resolver lòs problemas que atañen a nuestros recursos forestales. Procedamos, pues, a la obra animados de un espíritu de amistad y buena voluntad.

La colaboración internacional depende no sólo del libre intercambio de conocimientos científicos, sino también, y en gran parte, de una mejor inteligencia y entendimiento mutuos entre los pueblos de la Tierra.

Me es muy satisfactorio, pues, extender a nuestros colegas del exterior nuestra más cordial bienvenida y expresarles que confiamos en que su visita a nuestro país les sea muy grata y que les rinda resultados beneficiosos para su profesión.

The Forestry Profession in America

Henry Clepper

IN THE United States the scientific practice of forestry has been going on for sixty years only. This is the same length of time that the Society of American Foresters has been in existence.

Forestry, therefore, is not an old profession in America, as compared with medicine, for example, or law, engineering, or dentistry. But forestry has made steady progress over the years. Today there are not less than 17,000 professionally educated foresters who are practicing their profession or are working in fields closely allied to forestry.

Perhaps the most significant aspect of the development of our profession is the trend of employment. Approximately 7,500 foresters are currently employed in private and industrial forest operations. This number is equal to the total employed by public agencies —federal, state, county, and municipal governments.

These employment figures illustrate the pattern of forestry development. Forestry has not flourished because it has been predominantly a government enterprise; or because it was decreed under law.

No, forestry in America has thrived because it has been essentially a cooperative development. That is to say, the history of forestry has been characterized from the beginning by patterns of cooperation between federal, state, and local governmental agencies and private landowners and the forest products industries, and between these groups and our educational institutions and our experiment stations.

In a word, forestry is an example of what can be accomplished by politically independent people, living under a democratic form of government, and economically thriving under a system of free enterprise.

To be sure, forestry and the forest products business have not been without certain regulations by law. But in general forestry as a business has been free to organize and operate competitively for profit with a minimum of regulation by federal and state governments.

To put it another way, forestry in the United States has developed, not through legal coercion, but rather through the absence of it. To be sure, forestry is a function of governmental bodies—national, state, and local—because it is in the public welfare. But the reason forestry is practiced by many private landowners—small farmers and big corporations alike—is because it yields profits.

To understand the nature of American forestry, one must realize that it is a matter of concern to many public agencies, many businesses, many conservation organizations, many institutions of learning and research, many individual landowners, many ordinary citizens, in short, to many people. Admittedly, to that extent, forestry might be thought of as disorganized and fragmented. And indeed it is, if one is convinced that only a strong central authority exercising force is capable of organizing programs for the economic and social welfare.

In point of fact, forestry is characterized by a certain cohesiveness which might not be apparent to a visitor but which nevertheless exists. This unity has been largely the result of influence and activities of two national organizations: the 30,000-member American Forestry Association, a citizens' organization, founded in 1875; and the 13,500-member Society of American Foresters, founded in 1900, the professional organization. Through their meetings and publications, these two bodies have served as forums for the discussion of all aspects of forestry policies and techniques.

Lord Macaulay once wrote, "Men are never so likely to settle a question rightly as when they discuss it freely." These two national organizations, together with numerous regional, state, and local conservation groups, have provided the meeting places for open discussion that is fundamental to the democratic process.

Any student of American forestry frequently encounters instances of mistakes, financial waste, and inefficiencies during the formative years. To say that such things were probably inevitable in the enthusiasm of the young forest conservation movement is not to condone them. But in truth so much has been achieved despite occasional mistakes, waste, and inefficiences that, considering all accomplishments as a whole, they really do not matter at all.

Foresters are understandably proud of their contributions to the nation's economic growth, the social welfare, and the national defense. We are proud of our great system of national and state forests and parks. And we are equally proud of the many millions of acres of private and corporate holdings that are under good forest management.

In education, the United States has 43 universities and colleges offering professional programs in forestry at the professional level. Of these 28 are accredited by the Society of American Foresters. In addition, 26 institutions of higher learning offer introductory, preforestry, and specialized courses in

THE AUTHOR is executive secretary, Society of American Foresters.

forestry. And finally, three schools offer subprofessional curricula.

In research, our system of federal forest experiment stations and research centers, including the Forest Products Laboratory at Madison, Wisconsin, are constantly providing the field foresters with new techniques to apply in the woods. But this is not all. Numerous state agricultural experiment stations engage in forestry research, as do many of the forest industries. And several states and educational institutions also operate forest products laboratories.

Professional foresters are not complacent about the status of American forestry. The pride we feel in our accomplishments is in truth overshadowed by the realization that we have only made a beginning and have far to go.

With our expanding population and the gradual encroachment of urbanization on the woodlands, we realize that our forest must be more intensively managed in order to provide the goods and services that are essential to our way of life. Wood and wood fiber will be needed in greater volume, but so will water from our forested watersheds, and forest forage for domestic livestock, and food and habitats for wildlife. The growing impact of recreational use looms increasingly significant in management plans.

Consequently, "multiple use" is more than a concept or a technical term. It is an omnipresent reality, an insistent demand. The American forester could not escape it if he would, but of course he does not wish to. Aided by research, he tries, as effectively as he knows how, to apply the principle of multiple-purpose management regardless of what the dominant use of a given tract may be.

The World Forestry Congress—How It Was Organized

MORE THAN 300 leaders in American forestry and the forest industries helped organize the Fifth World Forestry Congress. Preparations began as soon as the invitation by the Government of the United States was accepted early in 1958.

Congress participants from other lands, as well as members of the Society of American Foresters, may wish to know the key forestry personnel who helped in the detailed preparations made by the eight working committees.

Organizing Committee

The first and principal working body was the Organizing Committee, appointed by the Secretary of State. With a membership of 44 men prominent in all fields of natural resources management, the committee functions under the able chairmanship of Richard E. McArdle, chief of the U. S. Forest Service.

William M. Gibson of the Office of International Conferences, Department of State, serves as vice chairman.

Henry Schmitz, president emeritus of the University of Washington, on whose campus the Congress will be held, was designated honorary vice chairman.

FIFTH WORLD FOTESTRY CONGRESS ORGANIZING COMMITTEE

RICHARD E. McARDLE
Chairman, Organizing Committee

Practically all of Dr. McArdle's career in forestry, spanning a period of 35 years, has been in the Forest Service, U. S. Department of Agriculture. Since 1952 he has been chief of the Forest Service. He is a Fellow of the Society of American Foresters and was the recipient of the distinguished service award of the U. S. Department of Agriculture in 1957.

HENRY SCHMITZ
Honorary Vice Chairman
Organizing Committee

Dr. Schmitz has had a distinguished career in education. He is a former director of the University of Minnesota School of Forestry, later dean of the University's College of Agriculture, Forestry, and Home Economics; and during the period 1952-1958 was president of the University of Washington. He is a Fellow and former president of the Society of American Foresters, and former editor of the JOURNAL OF FORESTRY.

Irvine T. Haig, a member of the Washington, D. C. staff of the U. S. Forest Service, was appointed the full-time executive secretary.

An honorary member of the committee is Harold A. Vogel, a representative of the North American office of the Food and Agriculture Organization of the United Nations, with headquarters in Washington, D. C.

Working Committees

An early decision by the Organizing Committee was the formation of eight working committees charged with the program, tours, finances, information and publicity, local arrangements, educational exhibits, exhibitions of machinery and equipment, and host responsibilities.

IRVINE T. HAIG
Congress Executive Secretary

During two decades in the U. S. Forest Service, Dr. Haig advanced to the position of chief of the Division of Forest Management Research, and later became director of the Southeastern Forest Experiment Station. Then for eight years he was in charge of the economics section of FAO's Forestry Division in Rome, returning to the United States in 1958 to become executive secretary of the Fifth World Forestry Congress.

Coordinator of these activities, serving as chairman of the Executive Committee, is V. L. Harper, assistant chief of the U. S. Forest Service in charge of the Branch of Research.

The Program

During the 13 conference days of the Congress, there will be three plenary sessions, three general sessions, and 13 technical sessions. The latter will be further divided into 36 sections treating of specific fields such as silviculture, logging, genetics, economics, forest products, tropical forestry, watersheds, recreation and wildlife, forest protection, and education. At least 200 speakers from 37 nations will appear on the program.

Heading up the Program Committee is Hardy L. Shirley, dean of the State University of New York College of Forestry, at Syracuse. In the arranging he was assisted by 13 specialists in the subject matter fields.

"Multiple Use of Forest Lands" is the theme of the Congress. As symbolized by the official emblem and emphasized by the program speakers, this concept will be shown to have worldwide application.

Tours

Tours are necessary to enable visitors from abroad to observe America's great variety of forest conditions, forestry practices, forest products industries, national forests and parks, state forests and parks, private and industrial

HENRY CLEPPER
General Chairman, Tours Committee

Mr. Clepper began his career in the Pennsylvania Department of Forests and Waters, and since 1937 has been executive secretary of the Society of American Foresters and managing editor of the JOURNAL OF FORESTRY. A Fellow of the Society, he was awarded the Gifford Pinchot medal in 1957. He is associate editor of *Forest Science*.

forests, forestry educational institutions, and forest experiment stations and research centers.

Accordingly, a National Tours Committee was set up with seven regional tours committees. Two pre-Congress and five post-Congress tours covering 8,000 miles were arranged to seven major forest regions, including Alaska. In addition, our Canadian colleagues arranged a post-Congress tour in British Columbia.

Serving as general chairman of the Tours Committee is Henry Clepper, executive secretary of the Society of American Foresters, Washington, D. C.

In addition to the two pre-Congress and five post-Congress tours, the Committee on Local Arrangements has provided for in-Congress tours. Of these, there will be six all-day tours and nine half-day tours.

Local Arrangements

Perhaps the one working committee with the greatest diversity of duties and responsibilities is the Committee on Local Arrangements. Its able chairman is Gordon D. Marckworth, dean of the College of Forestry at the University of Washington.

This committee has been responsible for housing and hotel reservations, in-Congress tours, registration, entertainment, and numerous other arrangements contributing to the efficient functioning of the assembly.

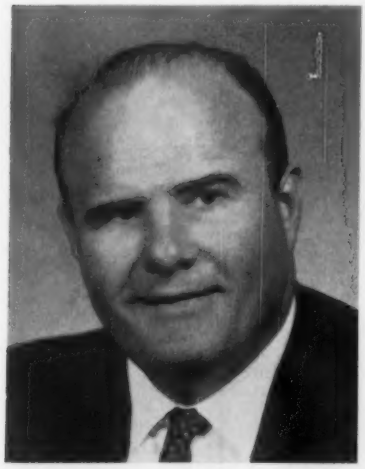
Information and Publicity

One of the first committees formed was charged with the duty of publicizing the Congress all over the world in order to assure representative attendance from the countries holding membership in the United Nations. Another charge on the committee was to disseminate widespread information about the Congress in the interest of improving forestry and related conservation measures throughout the world.

Heading this assignment is Clint Davis, director of the Division of Information and Education, U. S. Forest Service, Washington, D. C.

GORDON D. MARCKWORTH
Chairman, Local Arrangements

With a career in forestry education covering four decades, Prof. Marckworth has served as head of three accredited schools of forestry—at Louisiana State University, at the University of Georgia, and at the University of Washington where he has been dean of the College of Forestry since 1945. He is a Fellow of the Society of American Foresters and vice president of the Forest Genetics Research Foundation.



CLINT DAVIS
Chairman, Information and Publicity

A journalist by training, Mr. Davis was an outdoor writer and editor before joining the U. S. Forest Service where he has been engaged in public relations for two decades. He was director of the nation-wide forest fire prevention program of the Forest Service until becoming director of the Division of Information and Education five years ago.

VERNE L. HARPER
Chairman, Executive Committee

With a career extending over three decades in forestry research, Dr. Harper is a former director of the Northeastern Forest Experiment Station. Since 1951 he has been assistant chief of the U. S. Forest Service, directing research. A Fellow of the Society of American Foresters, he has long been active in international forestry, and is chairman of the Society's Committee on International Relations.

HARDY L. SHIRLEY
Chairman, Program Committee

Entering the U. S. Forest Service as a silviculturist, Dr. Shirley became director of the Northeastern Forest Experiment Station before going to the State University of New York College of Forestry where he has been dean of the College since 1952. He is chairman of the FAO Forestry Education Panel, and is active in international forestry organizations. He is a Fellow of the Society of American Foresters and is a former editor-in-chief of the JOURNAL OF FORESTRY.

EDWARD P. STAMM
Machinery and Equipment Exhibits

Starting his career as a logging engineer, Mr. Stamm has been active in forest industry for four decades, most recently having served as vice president of Crown Zellerbach Corporation. He is now a forestry consultant. He is former president of the Pacific Logging Congress and is currently vice president of The American Forestry Association.

Exhibits

Two kinds of exhibits have been arranged for the Congress.

Educational exhibits have been assembled under the chairmanship of a committee headed by Henry Schmitz, president emeritus of the University of Washington. These include display of informational and educational material by numerous organizations mainly in forest practice, and the various fields of forest conservation.

Exhibits of machinery and equipment used in forest operations, especially in logging and harvesting, have been arranged under the supervision of Edward P. Stamm, forest consultant of Portland, Oregon, and former vice president of Crown Zellerbach Corporation.

Finances

No meeting, large or small, can function properly without the aid of an efficient Committee on Finances. This committee has been responsible for the budget for the Congress and for the raising and disbursing of funds.

Its able chairman is G. Corydon Wagner, former president of the St. Paul and Tacoma Lumber Company of Tacoma, Washington.

Mr. Wagner has another important assignment; that is, serving as chairman of the Host Committee which arranges and coordinates social functions, entertainment, and receptions.

G. CORYDON WAGNER
Chairman, Finance Committee

An active leader in the forest industry of the Northwest for four decades, Mr. Wagner recently was retired as vice president and treasurer of the St. Paul and Tacoma Lumber Company of Tacoma, Washington. He is a former chairman of the Industrial Forestry Association and vice president of the Western Forestry and Conservation Association. He participated in the Third and Fourth World Forestry Congresses.

Progress in Forestry Is an International Process

William C. Bramble

AT THIS TIME, in the atmosphere of a World Forestry Congress we might well take a good look at the influence that forestry in other countries has had upon progress in American forestry. Without detracting from our own ingenuity in developing original research and our talent in application, I believe we can give full credit where credit is due, and thereby profit from a critical analysis of at least one major reason why we have gotten as far in forestry as we have in the short space of some sixty years.

We could probably peg the real beginning of forestry in the United States in the period around 1900. At this time the Society of American Foresters was founded, forest reserves had been established and would shortly be turned over to the administration of foresters in the Department of Agriculture, and our first forestry schools were founded.

The early beginnings of forestry education are well known. The Biltmore Story, the early European training of Gifford Pinchot, Henry S. Graves, and others give emphasis to the fact that our earliest forestry practices were based on ideas, training, and even personnel, from abroad. The names of C. A. Schenck and B. E. Fernow are synonymous with both private and public forestry in the early days. Four forestry schools in North America, including Biltmore, Penn State, Cornell, and Toronto, felt the influence of these two men in their founding days, and two of these are still leaders in the field of forestry education.

A striving to develop ideas and practices to fit the American scene and thus break away from European traditions led to the founding

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of the forestry school at Yale. At that time we had no American textbooks and pamphlets, and for many years those that were written bore the unmistakable imprint of ideas and techniques from other countries. From the early European textbooks and those first American books which stemmed from them, we have now developed some of the outstanding textbooks in the world in the field of forestry education. These works from our great teachers and researchers bear the imprint of American forestry, and we are no longer dependent on the old world for educational tools as we were in the past.

The effect of European traditions on forestry was good. No nation stands alone in scientific and professional advances and only a foolish man fails to use the knowledge gained by others as a springboard for newer and better advances using his own talents. This we should continue to do with profit to all concerned.

We must not forget, however, that we are still obtaining impetus in much of our research, and direction in many of our forestry and wood-using techniques, from abroad. In current years, for example, we have adapted the continuous forest inventory from the forests of France and Switzerland to our practice. Suited to large areas and to machine calculations, this technique now bears but a faint resemblance to its ancestor, but the original idea did come from abroad.

We could add to this the concept of plant sociology coming principally from the writings and texts of Braun-Blanquet in Switzerland, which have influenced much of our ecological work. The work of the Scandinavian foresters which emphasized site indicators and site types has helped us much in the correlation of sites to growth of forest stands.

More recently the Bitterlich prism has led to the development of the plotless cruise and the angle prism has become a familiar tool even in the hands of forestry students. This again is an imported item adapted and expanded for our use.

In the field of wood utilization, particle board development has been stimulated by imported processes. This has given us a new product that is helping solve some of our problems with low-grade hardwoods. As one of the most rapidly expanding new developments in the uses of wood, further research to lower its cost and raise some of its strength properties promises to revolutionize wood use in the future.

All this summed up makes clear that a free exchange of ideas and research results has helped tremendously in making rapid progress in American forestry possible. With imported ideas and techniques added to our achievements, we have gone far in the past sixty years, perhaps as far as older countries have gone in three hundred years. It means, further, that for future world progress we, in turn, should help nations that are now in their pioneer stages. Undoubtedly our experience as a young nation getting a start from knowledge accumulated by older nations and going on to develop our own American forestry fitted to the American scene is a pattern for future programs in forestry on an international scale. Some of these, of course, are already in progress but the field has barely been touched upon at the present time. Certainly forestry advances forged in Europe, tempered in America, will find sharper edges in countries yet undeveloped.

"Multiple Use of Forest Lands" is the theme of the Fifth World Forestry Congress. As symbolized by the official emblem, this concept has worldwide application. Forest and related areas should be managed in a manner that will conserve the basic land resource while at the same time producing high-level sustained yields of water, timber, recreation, forage, and wildlife harmoniously blended for the use and benefit of the greatest number of people.

Richard E. McArdle

Richard E. McArdle
Chairman, Organizing Committee

An Annotated Directory to Canadian and Foreign Workers in Forest Genetics and Related Fields

Compiled by the Committee on Forest Tree Improvement, Division of Silviculture, Society of American Foresters

R. T. Bingham, Editor

THE 744-name list below represents three years of compilation by the following present and past members of the Committee on Forest Tree Improvement: R. G. Hitt, H. B. Kriebel, F. I. Righter, E. B. Snyder, J. W. Wright, and B. J. Zobel. Workers on subjects related to forest genetics or tree improvement (notably flower induction, floral biology, cytology, embryology, introduction of exotics, provenance trials, physiology, seed physiology, seed collection, nutrition, and vegetative propagation of trees), except where concerned only with seed physiology, seed collection, vegetative propagation or nutrition with but one or a few species, are included, since most forest geneticists and tree breeders have wide interests in these subjects. More than 200 names of workers concerned with related subjects were omitted under the above exceptions. The Committee regrets that space limitations make these omissions necessary; it apologizes further for any inadvertent omissions.

The directory is divided into three parts as follows:

I. *Alphabetical list of workers, by subjects.* Workers are numbered consecutively in alphabetical order, their addresses being followed by two-letter, subject matter symbols, indicating by tree genera the subjects on which each has worked. Where more than one worker is located at a given station, the station address is given for only the first-listed worker; thereafter it is referred, by author-number, back to the first-listed worker at that station. Addresses are Americanized to the extent that workers' agencies are listed in descending organizational order (principal agency, then smaller and smaller subdivisions thereof), but in ascending order as to street, town or city, state or province, or country.

II. *Alphabetical list of subject matter symbols, by workers.* The two-letter subject matter symbols are listed alphabetically followed by a definition of the subject, then by the unique numbers of the various workers concerned with that subject.

III. *Alphabetical list of countries, with workers.* Countries are listed alphabetically, followed by an alphabetical list of workers located therein.

I—Alphabetical List of Workers

1. **Aass, Inger.** Det norske skogforsøksvesen, Vollebekk, Norway. CY, MU—*Pinus.*
2. **Abeywardena, V.** Coconut Research Institute, Lunuwila, Ceylon. HE, NU, TE—*Cocos.*
3. **Achterberg, H. H.** Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, Institut für Forstwissenschaften Eberswalde, Zweigstelle Eberswalde, Alfred-Möller-Strasse, Eberswalde, Zainhammer, East Germany. SL—General.
4. **Ahn, Koun Y.** Institute of Forest Genetics, Suwon, Kyunggido, Korea. HS—Conifers.
5. **Åkebrand, Verner.** Statens Skogsforskningsinstitut, Stockholm 51, Sweden. PR, SC, SL, ST, TE—General; BH—*Pinus.*
6. **Albensky, Anatoly V.** Scientific Research Institute of Forest Economy (NIILKH), Stalingrad, Russia. BM, GG—General; HG, HP—*Acer, Larix, Populus, Ulmus.*
7. **Alberti, F. Rial.** Ministerio de Agricultura, Dirección General de Laboratorios e Investigaciones, Instituto de Botanica, Arñoz 2875—Capital, Buenos Aires, Argentina. DR, HG, HN, IE, IR, MU, NT, PC, PL, TG—*Salix;* TA—*Acer.*
8. **Allegri, Ernesto.** Stazione Sperimentale di Selvicoltura, Via delle Cascine 1, Firenze, Italy. VA—*Pinus.*
9. **Allen, George S.** University of British Columbia, Vaucouver 8, British Columbia, Canada. EM, FL, PA, SC, SG—*Pseudotsuga;* SG—*Tsuga.*
10. **Alleweldt, G.** Forschungsinstitut für Rebenzüchtung, (22) Siebeldingen über Landau/Pfalz, West Germany. IN, TR—General; TR—*Acer, Betula, Carpinus, Latrix, Pinus, Populus, Taxus.*
11. **Alonzo, Abelardo E.** Estación Experimental Agropecuaria, Casilla Correo 14, Campana, Province Buenos Aires, Argentina. BM—*Pinus;* BM, DR, IR—*Salix, Populus.*
12. **Ammal, E. K. Janaki.** Forest Research Institute and Colleges, Regional Research Laboratory, Jammu (Jammu and Kashmir State), India. CY, EN, RA, VA—*Magnolia.*
13. **Andersson, Enar.** (Cf. No. 5). CV, EX, FR, IN, PD, SO, ST, TE—General; FL, FR, PA, PC, PD, PO, ST, TE—*Picea;* CT, PD, SO, ST, VC—*Pinus.*
14. **Andersson, Sven.** (Cf. No. 5). FR, IN, PD, SO—General, *Pinus, Picea.*
15. **Anić, Milan.** Univerzitet u Zagreb, Sumarski fakultet, Zagreb-Maksimir, P. P. 95, Yugoslavia. BM—*Castanea, Celtis, Pinus.*
16. **Anisimova, A. I.** Nikitsky Botan. Sad., Crimea, Jalta, Russia. IE, PH—General.
17. **Arnborg, Tore.** Föreningen Skogsträdsförädling, Arosgatan 7, Uppsala, Sweden. BH, CT, FR, GR, IE, SL—General; IN, PR, SO, ST, VA, VC—*Pinus, Picea.*
18. **Arru, Laura Z.** Ente Nazionale per la Cellulosa e per la Carta, In-

stituto di Sperimentazione per la Pioppicoltura, Casale Monferrato, Italy. EM, FL—*Eucalyptus.*

19. **Artaza, José E.** Ministerio de Agricultura, Direccion General de Montes, Caza y Pesca Fluvial, Instituto Forestal de Investigaciones y Experiencias, Carretera de la Coruña K.7, Apartado 8.111, Madrid, Spain. ST, TG—*Populus.*
20. **Asada, Setsuo.** Shinshu University, Faculty of Agriculture, Minamimiwa-mura, Nagano Prefecture, Japan. PH, PR, VA—*Larix.*
21. **Ashton, D. H.** University of Melbourne, Melbourne, Victoria, Australia. HA, HN, VA—*Eucalyptus.*
22. **Austin, Toralf.** Department of Agriculture, Forestry Branch, Oslo, Norway. FR, SC, SL—*Picea, Pinus.*
23. **Bagnaresi, Umberto.** Direttore technico, S. Stefano Cadore, Prov. Belluno, Italy. DR, GR, HP, IE, NU, PR—*Castanea.*
24. **Bakshi, B. K.** Forest Research Institute and Colleges, P. O. New Forest, Dehra Dun, India. DR—*Santalum.*
25. **Bang, Carl F.** (Cf. No. 5). PR, VP—*Pinus.*
26. **Bannan, M. W.** University of Toronto, Toronto 5, Ontario, Canada. VC, VP—*Cupressus, Thuja.*
27. **Bannister, M. H.** New Zealand Forest Service, Forest Research Institute, P. B. Whakarewarewa, Rotorua, New Zealand. EV, EX, TG—General; HG, HS, HY, TA—*Chamaecyparis, Cupressus;* BM, CO, HE, HN, PR, RE, TA, VA—*Pinus.*
28. **Bánó, Istvan, I.** Szombathely, Kámoni Arboretum, Hungary. SO, VG—*Pinus.*
29. **Barber, Horace N.** University of Tasmania, Hobart, Tasmania, Australia. EV, FO, HA, HG, TE, TG, VA—*Eucalyptus.*
30. **Barderi, Carlos H.** Centro Nacional de Investigaciones Agropecuarias, Castelar, Argentina. BM, DR, HG, TG—*Populus, Pinus.*
31. **Barner, Helmuth.** Statsskovens plantevlsstation, Humleback, Denmark. PR, SG—*Pseudotsuga;* FL, PC, PE—*Latrix, Quercus;* PE—*Picea, Pinus, Fagus.*
32. **Barner, Jörg M.** Universität Freiburg, Bertholdstrasse 17, Freiburg im Breisgau, West Germany. BM, CV, ST, TR, WA—*Populus;* FE—*Abies.*
33. **Barrett, Wilfredo H. G.** (Cf. No. 7). TA—*Pinus, Araucaria.*
34. **Bartels, H.** Universität Göttingen, Forstliche Fakultät, Werraweg 1, (20b) Hann. Münden, West Germany. SG, SP, SW—*Picea, Pinus;* SG, SP—*Larix, Pseudotsuga.*
35. **Battaglia, Emilio.** Universita di Pisa, Instituto Botanico, Via Luca Ghini 2, Pisa, Italy. CY—*Gymnospermae.*
36. **Bauer, F.** Sonnenweg 23, Stuttgart-Heumaden, West Germany. VA—*Quercus.*
37. **Bauer, Rudolf.** Max-Planck-Institut für Züchtungforschung, Erwin-Baur-Institut, Köln-Voglesang, West Germany. DR—*Ribes* spp. (to *Cronartium ribicola*).
38. **Bazzigher, Giovanni.** Eidgenössiche Anstalt für das Forstliche Versuchswesen, Birmensdorf-Zürich, Switzerland. DR—*Castanea.*
39. **Behrndt, G.** Landwirtschaftskammer Weser-Ems, Mars-La-Tour-Strasse 1-4, Oldenburg, West Germany. ST—*Pinus.*
40. **Beldie, Al.** Institutul de Cercetări Forestiere, Sos. Kisself, No. 55, Bucuresti, Romania. HN, TA—*Quercus.*
41. **Bellon, S.** Instytut Badawezy Lesnictwa, Wery Kostvzewy 3, Warszawa, Poland. HP—*Larix* hybrids.
42. **Benea, V.** (Cf. No. 40). HG—*Pinus.*
43. **Bergman, Fritz.** Föreningen Skogsträdsförädling, Northern District, Sundmo, Imforsmo, Sweden. DR, IN, PD, SO—General; IN—*Picea, Betula;* IN, SG—*Pinus.*
44. **Beuzenberg,** E. J. Department of Scientific and Industrial Research, Division of Botany, P. O. Box 2015, Christchurch, New Zealand. CY—*Coniferae.*
45. **Bialobok, Stefan.** Polska Akademia Nauk, Zaklad Dendrologii i Pomologii, Kornik k/Poznania, Poland. BM, GG, ST, TG—General, fruit trees; BM—*Populus.*
46. **Bialobrzeska, M.** Institute of Botany, Lubicz 46, Kraków, Poland. CO, FO, PO, SG—*Betula* spp., hybrids.
47. **Bier, J. E.** (Cf. No. 9). DR, IE—General.
48. **Binet, F. E.** Commonwealth Scientific and Industrial Research Organization (C.S.I.R.O.), Poultry Research Centre, Werribee, Victoria, Australia. HE, HN, TA—*Eucalyptus.*
49. **Biraghi, A.** Instituto di Patologia Forestale, Firenze, Italy. DR, ST—*Castanea.*
50. **Black, M.** University of Saskatchewan, Saskatoon, Saskatchewan, Canada. SG, TR—*Betula.*
51. **Blinkenberg, Chr.** Den. Kgl. Veterinaer-og Landbøhjskole, Hørsholm Arboretet, Denmark. PC—*Fagus.*
52. **Boden, R. W.** Department of the Interior, % Parks and Gardens Section, Canberra, A.C.T., Australia. HA—*Eucalyptus.*
53. **Boer, S. de.** Proefstation voor de Boomkwekerij, Valkenburgerlaan 3, Boskoop, Netherlands. VC—*Acer, Chamaecyparis, Cornus, Corylus, Elaeagnus, Ilex, Juniperus, Magnolia, Metasequoia, Picea, Populus, Prunus, Robinia, Taxus, Thuja, Tilia, Ulmus;* VG—*Juglans.*
54. **Boerner, F.** Botanischer Garten, Rossdorferstrasse 10, Darmstadt, West Germany, MU—*Picea.*
55. **Bogdanov, Petr L.** Forest Technical Academy of Kirov, Leningrad 18, Russia. BM, HG, SE, TR—*Populus;* TR—*Larix.*
56. **Bolland, Gerd.** Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, Institut für Forstwissenschaften Eberswalde, Waldsieversdorf, Märk. Schweiz, East Germany. BM, DR, ST—*Pinus;* BM, TG—*Pseudotsuga.*
57. **Bolsinger, Eberhard.** Forstdirektion Südwürttenburg/Hohenzollern, Abt. Waldbau, Schloss Bebenhausen, Tübingen, West Germany. PR—*Pinus, Pseudotsuga.*
58. **Boom, B. K.** Instituut voor de Veredeling van Tuinbouwgewassen, S. L. Mansholtlaan 15, P. O. Box 16, Wageningen, Netherlands. TA—General; HY, TA—*Populus, Ficus;* VA—*Acer.*
59. **Borset, Ola.** Norges Landbrukshøgskole, Institutt for Skogskjøtsel, Vollebekk, Norway. GI, PR—General.
60. **Boudru, M.** Institut Agronomique de l'Etat, Chaire d'Economie Forestière, Gembloux, Belgium. VA—*Larix.*
61. **Bourdeau, Philippe F.** Université Officielle du Congo Belge et du Ruanda-Urundi, Ruanda-Urundi, Belgian Congo. GR, PS, TR—*Pinus, Tsuga, Ailanthus;* FE, RE—*Pinus.*
62. **Bouvarel, Pierre F.** École Nationale des Eaux et Forêts, Station de Recherches et Expériences Forestières, 14 Rue Girardet, Nancy, France. GG, HG, PD, PL, SG, SL, SO, ST, VG—General; BM, PR, VA—*Picea, Populus, Larix.*
63. **Bovet, Jacques.** Université de Neuchâtel, Institut de Zoologie, Neuchâtel, Switzerland. CY, VA—*Fraxinus.*
64. **Brandt, K.** Danish Heath Society, Tree Breeding Station, Viborg, Denmark. PR—*Pinus.*
65. **Braun, Helmut J.** (Cf. No. 32) VC—Hardwoods; DR—*Pseudotsuga.*
66. **Brazier, J. D.** Forest Products Research Laboratory, Wood Structure Section, Princes Risborough, Aylesbury, Buckinghamshire, England. PQ, VA—*Shorea.*
67. **Broekhuizen, J. T. M.** Landbouwhogeschool, Wageningen, Netherlands. BM, TG—General; CV, DR, GR, ST, VC—*Populus.*
68. **Brown, Alan G.** Australia Department of Interior, Forestry and Timber Bureau, Canberra, A.C.T., Australia. CV, GR, PC, PQ, SF, ST, TE, TG, WQ—*Pinus.*
69. **Brückmann, Juan J.** Martin Rodriguez 875, Victoria, Province of Buenos Aires, Argentina. GR, IE, NT, VA—*Populus* clones.
70. **Bryndum, H.** Det Forstlige Forsøgsvaesen i Danmark, Springforbi, Denmark. CV, SF—*Populus* clones.
71. **Buchholz, E.** Bundesanstalt für Forst- und Holzwirtschaft, Abt. Forst- und Holzwirtschaftspolitik, Billeweg 7, Schloss Reinbeck/Hamburg, West Germany. GG—General; VC—*Quercus.*
72. **Bugala, Wladyslaw.** (Cf. No. 45). BM, HG, HP, IE, ST, VA—*Populus, Populus* hybrids.
73. **Burger, Hans.** (Cf. No. 38). GR, PR, SL—*Pinus.*
74. **Buszewicz, G.** Great Britain Forestry Commission, Research Branch, Forest Research Station, Alice Holt Lodge, Wrecclesham, Farnham, Surrey, England. SC, SG—General; PR—*Pinus.*
75. **Butin, H.** Universität Göttingen, Forstliche Fakultät, Biologische Bundesanstalt für land- und Holzwirtschaft, Institut für Mykologie und Holzschutz., Kasselerstrasse, (20b) Hann. Münden, West Germany. DR—*Populus.*
76. **Camefort, H.** Lycée Lakanal, Rue Edouard VII, 11, Paris (9ème), France. CY, EM—*Pinus.*
77. **Campo-Duplan, Mateleine van.** Museum National d'Histoire Naturelle, 61 Rue Buffon, Paris (Ve),

France. HG—*Tsuga, Picea;* PO—*Abies, Tsuga, Picea, Keteleeria* hybrids.

78. **Cappelli, Mario.** Università di Firenze, Facoltà Agraria e Forestale, Instituto di Selvicoltura, Piazzale delle Cascine, Firenze, Italy. FR, NU, SA, SC—*Pinus.*
79. **Carlisle, A.** The Nature Conservancy, Merlewood Research Station, Grange-Over-Sands, Lancashire, England. CO, FO, TA, VA—*Pinus;* HN, SG—*Betula.*
80. **Carmichael, A. J.** Province of Ontario, Department of Lands and Forests, Ontario Tree Seed Plant, Angus, Ontario, Canada. SA, SO—General; IR, PR—*Pinus.*
81. **Cepel, Necmettin.** Istanbul Üniversitesi, Orman Fakültesi Dekanligi, Büyükdere, Istanbul, Turkey. FE—*Pinus, Abies, Quercus, Fagus.*
82. **Champion, Harry G.** Commonwealth Agricultural Bureaux, Imperial Forestry Institute, Oxford University, Oxford, England. WG—*Pinus.*
83. **Chang, C. T.** Academia Sinica, Institute of Botany, Peking, China. PO—*Liquidambar.*
84. **Chiasson, Leo P.** St. Francis Xavier University, Department of Biology, Antigonish, Nova Scotia, Canada. CY, FL, HG, IR, ST, TG—*Abies.*
85. **Chiba, Shigeru.** Oji Institute for Forest Tree Improvement, Oji Paper Co., Ltd., Kuriyama-cho, Yubari-gun, Hokkaido, Japan. DR, FO, HA, PL, PO, PQ—*Cryptomeria;* HG, HS, SO, ST, VG—*Abies, Pinus, Picea, Larix, Betula, Alnus, Populus;* HA—*Castanea;* PL—*Larix.*
86. **Chichladse, L. S.** Georgian Academy of Agricultural Sciences, Tbilisi, Grusinskaja SSR., Russia. TG—General.
87. **Chien, J. J.** Kilin Normal College, Biological Department, Changcung, China. HN—*Abies.*
88. **Chmelar, J.** Vysoká skola zemedelská a lesnická, Lesnická fakulta, Brno, Czechoslovakia. IE, TA—*Salix.*
89. **Chmielewski, Witold.** (Cf. No. 41). BM, GG—General; HG—*Populus.*
90. Chodzicki, Edward. Polska Akademia Nauk, Zaklad Badan Lesnych, ul. Lokietka 1, Krakow, Poland, GI, VA—General.
91. **Chouinard, Levis.** Univedsité Laval, Faculté de Forestier, Québec, Canada. VC—*Betula, Populus, Larix, Acer;* CY—*Pinus.*
92. **Christie, J. M.** (Cf. No. 74). PR—*Pseudotsuga.*
93. **Clifford, H. T.** University of Queensland, Department of Botany, George Street, St. Lucia, Brisbane, Queensland, Australia. HN, SG, TA—*Eucalyptus.*
94. **Clonaru, Al.** Statiunea Institutul de Cercetări Forestiere, Oltenita, Romania. CV, HG—*Populus.*
95. **Codaccioni, Madeleine.** Laboratoire de Botanique de la Sorbonne, Paris, France. FL—*Castanea.*
96. **Condrashoff, S. F.** Department of Agriculture, Research Branch, Forest Biology Laboratory, 409 Federal Building, Victoria, British Columbia, Canada. IR, PH—*Populus.*
97. **Conrad, J.** Stadtwald Göttingen, Göttingen, West Germany. BM, ST, WG—*Fagus, Fraxinus, Quercus, Acer.*
98. **Contardi, H. G.** Universita Nacional de Cuyo, Facultad de Ciencias Agrarias, Mendoza, Argentina. HR, VA—*Eucalyptus.*
99. **Cornuz, Louis.** 16, chemin Chs.-Georg, Petit-Saconnex, Geneve, Switzerland. HN—*Quercus.*
100. **Costa, E. W. B. da.** Commonwealth Scientific and Industrial Research Organization (C.S.I.R.O.), Division of Forest Products, P. O. Box 310, South Melbourne, S. C. 5, Victoria, Australia. DR—*Tectonia.*
101. **Cram, William H.** Department of Agriculture, Research Branch, Forest Nursery Station, Indian Head, Saskatchewan, Canada. CS—General; CO, FO, SG, SI, VG—*Picea;* VG—*Pinus;* BM, SG, SI—*Caragana;* CV, HP, VC—*Populus;* SC—*Acer, Fraxinus.*
102. **Curschmann, O. H.** Forsthehöft, Lärtz/Ausbau, Kreis Neustrelitz, Mecklenburg, West Germany. SO—General, VC—*Abies.*
103. **Cvancara, R.** Skolní závod Lesnické fakulty Praha, Kostelec n. C. 1, Czechoslovakia. GG, NT—General, PR—*Larix.*
104. **Cvrkal, H.** 873, Brezinova, Dvur Králové, Czechoslovakia. BW, VA—*Pinus.*
105. **Dadswell, Herbert E.** (Cf. No. 100). HE, PQ, WQ—*Eucalyptus, Pinus.*
106. **Dance, B. W.** Department of Agriculture, Research Branch, Forest Biology Laboratory, Southern Research Station, Route 2, Maple, Ontario, Canada. DR—*Populus* hybrids.
107. **Danilov, M. D.** Povolzhye Forestry Institute, Mari Soviet Autonomous Republic, Yoshkar-Ola, Russia. PH—*Populus.*
108. **Dansereau, Pierre.** Université de Montréal, L'Institut Botanique, 4101 Est Rue Sherbrooke, Montréal 36, Quebec, Canada. HN—*Acer.*
109. **David, R.** Université de Bordeaux, Faculté des Sciences, Laboratoire de Biologie Vegetal, Bordeaux, France. GR, PS, SG, VC—*Pinus.*
110. **Davis, Trupapur A.** Central Coconut Research Station, Kayangulam, India. BM, DR, NU, PC, PS—*Cocos.*
111. **Day, William R.** Oxford University, Department of Forestry, Oxford, England. DR, HA—General, *Larix, Populus.*
112. **Dellingshausen, Margarete von.** Botanisches Institut, Menzingerstrasse 67, München 38, West Germany. GG, PS—General; FL—*Betula.*
113. **DeMortier, G.** Institute de Agronomie et des Station de Recherches de Gembloux, Laboratoire de Chime et Physique Agricole, Gembloux, Belgium. FE—*Pinus;* VC—*Populus.*
114. **Dieckert, H.** (Cf. No. 34). FL—General.
115. **Dietrichson, Jon F.** (Cf. No. 1). BM, GG, HA, HG, PR, SE—General.
116. **Dilleman, G.** Faculté de Pharmacie, Rue Henri Barbusse, 42, Paris (5ème), France. HN—*Populus, Salix, Larix.*
117. **Dimpflmeier, Rudolf.** Bayerische Forstliche Forschungsanstalt, Amalienstrasse 52, München 13, West Germany. BM, HG, HS, VG—*Larix.*
118. **Dittmar, O.** (Cf. No. 56). PR—*Pseudotsuga.*
119. **Dobrinov, I.** Visch Lesotechnitcheski Institut, 8. Darvenitza, Sofia, Bulgaria. GG—General; VA *Pinus.*
120. **Domokos, J.** Villányi ut 29, Budapest, XI, Hungary. BM, HR, VA, VP—*Fraxinus.*
121. **Donner, Joakim.** Helsingin Yliopisto, Helsinki, Finland. PO—*Alnus.*
122. **Doyle, Joseph.** University College, Botany Department, Upper Merrion Street, Dublin, Ireland. EM, FL, PC—*Pinus, Tsuga, Abies, Picea, Sequoia, Cedrus, Pseudotsuga, Larix,* and other rare conifers.
123. **Dumitriu-Tataranu, I.** (Cf. No. 40). IE, SL—General.
124. **Dusek, V.** Ceskoslovenská akademie zemědelskych věd, Vyskumny ústav lesního hospodárství a myslivosti, Opocne pod Orlickyml horami, Czechoslovakia. HA, IE, NT, VC—*Eucalyptus;* BM—*Populus.*
125. **Dylis, Nikolai V.** Academy of Science, U.S.S.R., Forest Institute, P/O Uspenskoe, Zvenigorod District, Moscow Region, Russia. BM, SE—*Larix.*
126. **Dzhiaukshtas, Pranas s I.** Scientific Research Institute of Forest Economy (NIILKH), Lithuanian SSR, Stalin Prospect 29, Kaunas, Russia. BM, SE—*Corylus.*
127. **Ebell, Lorne F.** (Cf. No. 96). PD—*Pinus, Pseudotsuga, Abies, Thuja, Chamaecyparis.*
128. **Edwards, M. V.** Great Britain Forestry Commission, Research Branch, Government Building, Bankhead Avenue, Sighthill, Edinburgh 11, Scotland. EX, FE—General; PR—*Picea, Pinus, Pseudotsuga, Larix;* HG, PH—*Larix.*
129. **Ehrenberg, Carin E.** (Cf. No. 5). SG—General; FL, FR, PC, VT, TE—*Pinus;* PO—*Ulmus.*
130. **Eichbaum, Karl L. J.** Geschäftsstelle für das Pappelmarkenetikett, Kronprinzenstrasse 16, Bonn, West Germany. DR, HA, HR—*Populus.*
131. **Eiche, Vilhelms J.** (Cf. No. 6). EV, HE, PR—General; MU—*Pinus.*
132. **Eifler, Irmgard.** (Cf. No. 56). BG, PL—*Betula;* PL—*Picea.*
133. **Eisenhut, Georg.** (Cf. No. 117). BM, FL, SE, TG—General; FL, SG—*Tilia.*
134. **Eldridge, Kenneth G.** Australia Department of Interior, Forestry and Timber Bureau, Forest Experimental Station, % A.P.M. Forests Pty. Ltd., P. O. Box 71, Traralgon, Victoria, Australia. GR, PQ, SF, ST, WQ—*Pinus;* GR, HG, PQ, SF, ST, WQ—*Eucalyptus.*
135. **Elorrieta, Jose.** Ministerio de Agricultura, Direccion General de Montes, Caza y Pesca Fluvial, Instituto Forestal de Investigaciones y Experiencias, Puerta de Hierro, Madrid, Spain. BM, TG—*Populus, Castanea.*
136. **Ende, G. van den.** University of Nijmegen, Botany Department, 36

Kapittelweg, Nijmegen, Netherlands. DR—*Populus.*

137. **Enkova, Elizaveta I.** Scientific Research Institute of Forest Economy (NIILKH), Lomonosova Street M. B., Voronezh, Russia. BM, SE—*Quercus.*
138. **Erdtman, Gunna.** Palynological Laboratory, Nybodagatan 5, Stockholm-Solna, Sweden. EV, PO—General.
139. **Erdtman, Holger.** Kungl. Tekniska Högskolan, Organisk-kemiska Institutionen, Stockholm 70, Sweden. BW, DR—Heartrots.
140. **Ermakov, Vladimir I.** (Cf. No. 125). BM, SE—*Pinus.*
141. **Ernst, Wilhelm.** Bundesministerium für Ernährung, Landwirtschaft, und Forsten, Bonn Duisdorf, West Germany. SL—General.
142. **Erteld, W.** (Cf. No. 3). GR, PR—*Pinus.*
143. **Farrar, John L.** (Cf. No. 26). PR, PS—General; VC—*Picea, Pinus.*
144. **Faulkner, Roy.** (Cf. No. 128). FE, NT, SG, SO, ST—General.
145. **Favre-Duchartre, M.** Cité Universitaire d'Antony (Seine), Faculté de Sciences de Reims, Laboratoire de la chaire de Biologie végétale, Reims, France. CY, PL—*Cephalotaxus, Taxus, Ginkgo.*
146. **Fernando, D. M.** Rubber Research Institute, Dartonfield, Agalawatte, Ceylon. BM, DR, RE, TG—*Hevea.*
147. **Ferre, Y. de.** Faculté des Sciences, Rue du Conard, 7, Toulouse (Hte-Gauronne), France. DR—*Pseudotsuga.*
148. **Fielding, John M.** (Cf. No. 68). BH, BM, GR, HG, HR, HS, PD, PS, SF, ST, TE, VA, VC, VG, WQ—*Pinus;* FL—*Eucalyptus.*
149. **Filimonova, Valentina D.** (Cf. No. 125). BM, SE—*Populus.*
150. **Finnis, J. M.** Province of British Columbia, Department of Lands and Forests, Forest Service, Research Division, Victoria, British Columbia, Canada. CP, SA, SC—General.
151. **Fischer, Fritz.** (Cf. No. 38). DR, HE, HG, IR—General; BM, ST, VC—*Castanea;* DR, PR, ST, TE—*Pinus;* PR, SF, VA, VG—*Larix;* BM, HS—*Taxus.*
152. **Flöhr, W.** (Cf. No. 130). PR—*Pseudotsuga.*
153. **Florin, Rudolf.** Bergianska Trädsgården, (Hortus Bergianus), Stockholm 50, Sweden. EM, PO, RA, TA—*Gymnospermae.*
154. **Florence, R. G.** Queensland Department of Forestry, 108 George Street, Brisbane, Queensland, Australia. BH, FR, HE, PD, SA, SF, SO, ST, TE—*Pinus;* ST—*Araucaria, Agathis.*
155. **Fouarge, J.** Laboratoire forestier de l'État, Gembloux (Namur), Belgium. FE—*Pinus;* FE, VC—*Populus.*
156. **Fowler, Donald P.** Province of Ontario, Department of Lands and Forests, Research Branch, Southern Research Station, Maple, Ontario, Canada. DR, FR, HG, HP, HS, IN, IR, NT, PC, SG, VG—*Pinus, Thuja.*
157. **Franclet, A.** Station de Recherches Forestières, Rabat, Morocco. BM, ST—*Eucalyptus.*
158. **Fraser, D. A.** Department of Northern Affairs and National Resources, Forestry Branch, Petawawa Forest Experiment Station, Chalk River, Ontario, Canada. FE, PS—General; FL, FR, PH, PS—*Picea.*
159. **Fröhlich, Hans-Joachim.** Hessische Forsteinrichtungs- und Versuchsanstalt, Zweigstelle Forstpflanzenzüchtung, Veckernhagener Strasse, Hann. Münden, West Germany. PR, PS, SO, VC—General; BM, SO—*Pseudotsuga;* DR, SO—*Pinus;* PS, VC—*Populus;* SO—*Larix, Sequoia;* PS, SO—*Picea.*
160. **Frolova, G. D.** VNIALMI, Stalingrad, Russia. PC, SI—*Robinia;* FL—*Betula.*
161. **Fukarek, Powle.** Univerziteta-Sarajevo, Sumarski Fakultet, Institute of Forest Botany, Zagrebačka 18, Sarajevo, Yugoslavia. PR, VA—*Pinus, Fraxinus.*
162. **Fukuda, Margota.** Anezaki-cho, Ichihara-gun, Chiba Prefecture, Japan. ST, VC—General.
163. **Funabiki, Kozo.** Niigata University, Faculty of Agriculture, Niigata, Japan. CY—General.
164. **Gadd, Ivor.** % Swedish State Seed Testing Station, Stockholm, Sweden. SG, SL—General.
165. **Gallastequi, Cruz.** Mision Biolojica, Pontevedra, Spain. TG—*Castanea.*
166. **Galoux, A.** Ministère de l'Agriculture, Station de Recherches des Eaux et Forêts, Groenendaal (Hoeilaart), Belgium. FE, SA, VA—General; PR—*Pseudotsuga.*
167. **Gantchev, P.** Bulgarska akademia na naukite, Institut za gorada, Sofia, Bulgaria. ST, VG, VP—*Populus;* SG—*Quercus.*
168. **Garavel, L.** Rue Gustave Flaubert, 4, Grenoble (I-sère), France. HA, NT, NU—*Juglans.*
169. **Gardiner, A. S.** (Cf. No. 74). BA, BM—*Betula.*
170. **Garman, E. H.** (Cf. No. 150). IE—General; HN, TA—*Picea.*
171. **Garner, R. J.** East Malling Research Station, Near Maidstone, Kent, England. CV, VG, VP—*Malus, Prunus.*
172. **Gathy, Pierre.** (Cf. No. 166). IE—General; HG, PR, SF, SL, SO, SS—*Abies, Picea;* CT, VG—*Pinus, Pseudotsuga, Fagus, Quercus.*
173. **Gaussen, H. M.** Université de Toulouse, Faculté des Sciences, Laboratoire Forestiére, Toulouse, France. HG, TA, VA—*Pinus;* PO—*Abies, Tsuga, Picea, Keteleeria* hybrids.
174. **Georgopoulos, A.** Ministry of Agriculture, % Forest Service, Institute of Forest Resources, Athens, Greece. GR, PH, VC—*Populus.*
175. **Gerhard, H.** Universität Kiel, Schleswig, Flensburgerstrasse 13, Kiel, West Germany. BM—*Populus.*
176. **Gerritsen, C. J.** G. A. van Swieten Hogere Tuinbouwschool, Frederiksoord, Netherlands. ST—*Quercus;* FR, ST—Nut trees.
177. **Gindel, J.** Agricultural Research Station, Rehovoth, Israel. HR, IE—General.
178. **Giordano, Ervedo.** Centro di Sperimentazione Agricola e Forestale, C. P. 9079 Roma, Roma, Italy. BM, CY, DR, HE, HG, TR—*Eucalyptus, Populus, Pinus.*
179. **Globa-Mikaienko, D. A.** NILOS, Sochi, Russia. BM, SE—*Eucalyptus.*
180. **Göhre, K.** (Cf. No. 3). GR, VA—*Picea, Pinus, Pseudotsuga.*
181. **Gohrn, V.** (Cf. No. 70). PR—General, *Larix, Picea.*
182. **Golfari, Lamberto.** Diagonal Norte 938, Capital, Buenos Aires, Argentina. IE, NT—*Populus.*
183. **Gonda, Peter.** 23, Hejdukova,Bratislava, Czechoslovakia. BM—*Sequoia, Liriodendron, Eleagnus.*
184. **Goo, Masashi.** University of Tokyo, Hongo, Tokyo, Japan. SG—General; MU, SG—*Pinus, Chamaecyparis;* FL, GR, MU, SG, ST—*Cryptomeria.*
185. **Gothe, Heinrich L.** An der Vorderburg 7, Schlitz/Hessen, West Germany. DR, GR, HA, HG, PH—*Larix.*
186. **G.-Penteado de Castro, Yone.** Estado de Sao Paulo, Servico Florestal, Caixo Postal 1322, Sao Paulo, Brazil. BM, SE, SO—*Eucalyptus, Cupressus, Cunninghamia, Pinus;* VA—*Araucaria.*
187. **Grace, H. N.** Research Council of Alberta, University of Alberta, Edmonton, Alberta, Canada. VC—*Picea, Pinus, Salix, Taxus.*
188. **Grandgirard, A.** University of Besançon, Faculty of of Science, Institute of Botany, Besançon, France. PS, TR—*Pinus.*
189. **Gregory, P. H.** Imperial College of Science and Technology, London, S. W. 7, England. PD—General.
190. **Grehn, J.** Johanneshof 15, Wetzlar/Lahn, West Germany. CY, GR, HG, SW—*Populus.*
191. **Gremmen, J.** Stichting Bosbouwproefstation, "De Dorschkamp," Postbus 23, Wageningen, Netherlands. DR—*Populus, Pinus.*
192. **Griffith, A. L.** East African Agriculture and Forestry Research Organization, P. O. Box 21, Kikuku, Kenya, East Africa. GI, SO—General; HG—*Cupressus;* BM, IE, SE—*Pinus, Acacia, Eucalyptus.*
193. **Grigor'ev, G. V.** Botanical Garden, Karaganda, Kasahskoi SSR, Russia. TG—General, *Populus, Betula.*
194. **Grüll, H.** Forstliche Bundes-Versuchsanstalt, Mariabrunn in Schönbrunn, Wein XIII/89, Ob. Tirolergarten, Austria. SO, SS, ST, TR—*Pinus.*
195. **Guerreiro, Manuel G.** Instituto de Investigação Científica de Moçambique, C. P. 1780 Lourenço Marques, Moçambique, Mozambique (Portugese East Africa). BM, DR, FO, FL, HG, VC, VG—*Castanea;* BM—*Populus.*
196. **Guimaraes, Rubens F.** Horto Florestal Navarro de Andrade, Caixo Postal 29, Rio Claro, Estado de Sao Paulo, Brazil. CY, FL, GR, HG, HS, PR, SI, ST, TA, TE, VC—*Eucalyptus.*
197. **Guinaudeau, Jacques.** École Nationale des Eaux et Forêts, Station de Recherches et Expériences Forestières, Annexe de Bordeaux, Rue de Laseppe, 62, Bordeaux (Gironde), France. BM, FE, HG, SE, VG—*Pinus.*
198. **Günther, H.** Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, Institut für Forstwissenschaften Tharandt, Tschaikowsky Platz 7, Graupa/über Pirna, East Germany. BM, HA, RO, VC—*Populus;* VC—*Rhus.*
199. **Günzl, Leo.** Hohenlehen, Post Hol-

lenstein, Austria. HP, IE, TA—*Populus, Salix.*

200. **Gupta, M.** Uttar Pradesh Forestry Department, % Chief Conservator of Forests, Lucknow, Uttar Pradesh, India. IE—*Eucalyptus.*
201. **Gurgel-Filho.** Octavio do A., Horto Experimental de Santa Rita do Passa Quatro, Caixo Postal 15, Estado de Sao Paulo, Brazil. SG, VC, VG—General.
202. **Gustafsson, Ake.** (Cf. No. 5). CO, GG, MU, PA, SG, ST—General; CO FR, SG, VG—*Pinus.*
203. **Guttenberg, Hermann von.** Universität Rostock, East Germany. CY—*Cupressus, Cascarina.*
204. **Hadders, Gustaf.** (Cf. No. 17). BH, CT, FR, GR, ST, VG—*Pinus, Abies.*
205. **Hagman, Max.** Metsäntutkimuslaitos, Forest Tree Breeding Station, Maantiekyla, Finland. BM, CT, EV, HG, PS, SC, SO, ST, VG—General, *Populus, Pinus, Picea, Betula, Larix.*
206. **Hagner, Stig.** (Cf. No. 5). FR, SG—*Pinus*, FR—*Picea.*
207. **Hair, John B.** (Cf. No. 44). CY—*Coniferae.*
208. **Håkansson, Artur.** Lund University, Lund, Sweden. CY, EM, PL—*Salix, Betula, Pinus.*
209. **Hamaya, Tosio.** (Cf. No. 184). RA, TA—*Populus.*
210. **Harada, H.** Ministry of Agriculture and Forestry, Forestry Agency, Government Forest Experiment Station, Shima-meguro-4, Meguro-ku, Tokyo. IN—General; FE—*Larix;* NT—*Cryptomeria.*
211. **Harding, John H.** South Australia Woods and Forests Department, Research Investigation Office, Rundle Street, Adelaide, South Australia, Australia. BM, CY, HE, SO, ST, VG—*Pinus.*
212. **Harland, S. C.** Wemips Cottage, Blackheath S. E. 3, London, England. BM, NU, ST—*Cocos.*
213. **Harm, Heinz.** Forstliche Bundes-Versuchsanstalt, Anstalt Mariabrunn, Hauptstrasse 7, Wein XIV, Hadersdorf, Austria. RE—*Pinus.*
214. **Hasegawa, Masao.** (Cf. No. 210). PS, WQ—General; SG—*Pinus.*
215. **Hashizume, Hayato.** Tottori University, Faculty of Agriculture, Tottori, Japan. PC, VG—*Pinus.*
216. **Hassenkamp, W.** Forstamt Syke, Syke b. Bremen, West Germany. SO—General.
217. **Hatano, Ken-ichi.** (Cf. No. 184). PO, SG—General; SG—*Pinus.*
218. **Hausser, K.** Baden-Württembergische Forstliche Versuchs- und Forschungsanstalt, Abt. Ertragskunde, Fürstenstrasse 6, Aussenstelle Hechingen/Hohenz., West Germany. CO, FE, SO—*Pseudotsuga, Picea, Pinus, Larix, Abies.*
219. **Heikinheimo,** Olli. Metsäntutkimuslaitos, Unioninkatu 40 A, Helsinki, Finland. IE, SL—General; WG—*Betula.*
220. **Heimburger, Carl C.** (Cf. No. 156). GG, IE, IR—General; DR, GR, HG, HP, VC—*Populus;* DR, GR, HG, HP, HS, IN, IR, PR, SF, SO—*Pinus;* PR—*Picea, Thuja.*
221. **Heitmüller, H. H.** Bundesforschungsanstalt für Forst- und Holzwirtschaft, Institut für Forstgenetik und Forstpflanzenzüchtung, Zweigstelle Wächtersbach, Friedrich-Wilhelm-Strasse 28, (16) Wächtersbach (Hessen), West Germany. CT, IN, IR, PC, SO—*Pseudotsuga;* VC—*Populus;* SI—*Alnus.*
222. **Hejnowicz, Z.** Wroclaw University, Wroclaw, Poland. MU—*Juniperus;* PQ—*Robinia, Populus.*
223. **Hellinga, G.** (Cf. No. 67). HG, HS, PC—*Populus;* FL, PR, ST, VP, WG—*Pinus, Tectonia,* and other Indonesian spp.
224. **Hellström, Nils A.** A/B KABI, Research Department, Stockholm 30, Sweden. PC, PO—General.
225. **Herrmann, Siegfried.** (Cf. No. 34). IN, VG—*Pinus, Picea.*
226. **Hesmer, H.** Beethovenstrasse 30, Bonn, West Germany. IR, PH—*Quercus.*
227. **Heybroek, Hans M.** Stichting Bosbouwproefstation, "De Dorschkamp," % Phytopathological Laboratory, "Willie Commelin Scholten," Javalaan 20, Baarn, Netherlands. BM, DR, HG, RO, WQ—*Ulmus;* DR—*Alnus.*
228. **Hirayoshi, Isawo.** Gifu University, Faculty of Agriculture, Laboratory of Genetics, Gifu, Japan. CY, PL—General.
229. **Hjelmqvist, H.** (Cf. No. 208). TA—General; EM—*Fagales.*
230. **Hoffmann, Kurt.** (Cf. No. 56). SO, VG—*Pinus, Larix, Pseudotsuga.*
231. **Hofman, J.** Ceskoslovenská akademie zemědělskych věd, Vyzkumny ústav lesního hospodárství a myslivosti, Zbraslav-Strnady č. 167, Czechoslovakia. BM—*Picea;* PH—*Quercus, Fagus, Carpinus, Tilia.*
232. **Holmes, G. D.** (Cf. No. 74). CO, IN, NT, SG, SL—General; PR—*Pinus.*
233. **Holst, Mark J.** (Cf. No. 158). HG, HS, IE, IR, PR, SI, ST, VA—General; DR, GR, HG, IR, PQ, TE, VA, VG—*Picea, Pinus.*
234. **Holzer, Kurt.** (Cf. No. 213). BM, CY, TG—*Pinus, Alnus, Picea.*
235. **Hong, Soon C.** (Cf. No. 4). CT, HG, ST, VC—General (hardwoods), *Populus.*
236. **Hopkins, E. R.** Western Australia Forests Department, Treasury Buildings, Perth, West Australia, Australia. SO, ST—*Pinus.*
237. **Huber, Bruno.** (Cf. No. 117). SO, VG—General; CT, GR, PS—*Populus.*
238. **Hunter, A. W. S.** Department of Agriculture, Research Branch, Central Experimental Farm, Ottawa, Ontario, Canada. BM, DR, HG, PL, ST, VC—*Ulmus;* DR—*Ribes* (to *Cronartium ribicola*).
239. **Hunziker, Juan H.** Instituto Nacional de Tecnologia Agropecuaria, Secretaria de Agricultura y Ganaderia, Castelar, Province Buenos Aires, Argentina. CY, IE, PL—*Salix, Salix* hybrids.
240. **Hutchinson, A. H.** (Cf. No. 9). GG—General; EM—*Abies;* CY, VA—*Pseudotsuga.*
241. **Hyde, H. A.** National Museum of Wales, Cardiff, Wales. FR, PD—General, *Fagus.*
242. **Hylander, Nils.** University of Uppsala, Botanical Garden, Uppsala, Sweden. TA—General; FO—*Betula;* FO, HN—*Alnus.*
243. **Hyun, Sin K.** (Cf. No. 4). GR, HG, HP, PL, ST—*Pinus;* HG—*Populus.*
244. **Ikuse, M.** Toho University, Pharmaceutical Faculty, Narashino, Tiba, Japan. PD, PO—*Juglandaceae, Salicaceae, Fagaceae.*
245. **Illies, Zoe-Maria.** Bundesforschungsanstalt für Forst- und Holzwirtschaft, Institut für Forstgenetik und Forstpflanzenzüchtung, Siekerlandstrasse 2, (24a) Schmalenbeck über Ahrensburg, West Germany. CY, PL—*Larix;* CY—*Picea.*
246. **Ingestad, Torsten.** (Cf. No. 5). FE—*Pinus, Picea, Betula.*
247. **Inokuma, Taizo.** (Cf. No. 184). IE, RA, TA—*Populus.*
248. **Ishii, Seiji.** Kôchi University, Faculty of Agriculture, Kachomura, Kami-gun, Kôchi Prefecture, Japan. PR—General.
249. **Ishikawa, H.** (Cf. No. 210). IN—*Cryptomeria.*
250. **Ishikawa, Sigeo.** Tokyo University of Education, Ikijiri-cho, Setagayaku, Tokyo, Japan. SG, TR—*Pinus, Paulownia.*
251. **Ishizaki, Atsumi.** (Cf. No. 210). ST, VC—General.
252. **Ito, Itsuhiko.** Kyoto Huritu University, Faculty of Agriculture, Kyoto, Japan. PL—*Asimina;* HG—*Pinus.*
253. **Ito, Tokuhiko.** (Cf. No. 210). HG—*Pinus.*
254. **Iturria, Hernan C.** Casilla 442, Chillán, Chile. IE, NT—*Populus, Salix.*
255. **Ivannikov, Seraphim P.** Scientific Research Institute of Forest Economy (NIILKH), Pisarevskaya Street No. 12, Lushkino, Moscow Region, Russia. BM, SE—*Populus.*
256. **Iwakawa, Mitsuo.** (Cf. No. 210). PC, PO, SG, ST, TR—*Pinus;* PO—*Cryptomeria.*
257. **Iwamura, Mitimasa.** Okayama University, Faculty of Agriculture, Okayama, Japan. MU, ST—General.
258. **Jablokov, A. S.** Scientific Branch, Institute of Forestry, V NIILM Otdel Selekcii, Puskino, Moscow Province, Russia. BM, GG, PS, ST—General; GR, HA, ST—*Juglans;* DR, ST—*Populus.*
259. **Jackson, W. D.** (Cf. No. 29). EV, FO, HA, HN, VA—*Eucalyptus.*
260. **Jahnel, H.** Forstbotanischen Institut Tharandt, Prüfstelle für Forstsaatgut, Dippoldiswalder Strasse 7, Tharandt/Sa., East Germany. HA—*Picea, Abies, Pseudotsuga, Quercus, Fagus, Carpinus, Fraxinus, Alnus, Betula, Acer, Populus;* DR, HA, SG—*Pinus.*
261. **Jamblinne de Meux, Alain de.** Centrum voor Bosbiologisch, Centre de Recherches en Biologie Forestière, Onderzoek V.Z.W.D., Bokrijk-Genk, (Post Winterslag), Belgium. IE, PE, PR, PS, SO, VA, VC, VG, WQ—General (conifers); HG, HP, PC, TE—*Pinus.*
262. **Jansen, Ernst C.** Stichting Verbetering Houtopstanden, Wageningen, Netherlands. SA, SO, SS, ST—General.
263. **Janson, Lucjan.** (Cf. No. 41). GG, VP—General.
264. **Jeffers, J. N. R.** (Cf. No. 74). EX—General.
265. **Jensen, Steffan,** Ramlösa Plantskola, Helsingborg, Sweden. CT, CV, SO, VC, VG—*Betula, Quercus, Pinus, Picea;* PL—*Sequoia.*

266. **Jentsch, J., Sachsen.** Forstlichen Versuchsanstalt (Tharandt), Lilienstrasse 2, 1., (10b) Leipzig 0.5, East Germany. PR—*Pinus.*
267. **Jentys-Szaferowa, J.** Polska Akademia Nauk, Institute of Botany, Department of the Variability of Plants, Lubicz 46, Kraków, Poland. CO, EV, FO, TA, TG—General, *Betula.*
268. **Joachim, Hans-Friedrich.** (Cf. No. 3). HA, PH, TA—*Populus.*
269. **Jobling, J.** (Cf. No. 74). IE, VA, VC—*Populus.*
270. **Johnson, L. P. V.** University of Alberta, Edmonton, Alberta, Canada. HG, MU, PC, PQ, SG—*Populus*; HG—*Ulmus*; CY, HG, PC, PE, ST—*Pinus.*
271. **Johnsson, Helge.** Föreningen Skogsträdsförädling, Ekebo, Svalöv, Sweden. BM, HG, IN, PL, SI, TE, TG, WG—*Betula*; MU—*Alnus*; BM, CY, PC, PR, SL, SO, ST, TG—*Pinus*; BM, DR, HG, HP, PL, TG—*Populus*; CY—*Larix, Picea.*
272. **Johri, B. M.** University of Delhi, Department of Botany, Delhi, India. EM, FL—*Ficus.*
273. **Jones, Eustace W.** (Cf. No. 82). DR, FL, FR, HA, PH, RA—*Quercus.*
274. **Jones, John H.** Department of Agriculture, Botanical Gardens, Paget East, Bermuda. IE, PR—General.
275. **Josowidjojo, Loekito D.** Department of Agriculture, Central Institute of Forest Branch, Bogor, Indonesia. BM, SE—*Pinus, Tectonia.*
276. **Jovanovic, Branislav.** Sumarski fakultet, Kneza Višeslava 1, Beograd, Yugoslavia. SC—General; HG, HN, TA—*Populus*; FR, PH, TA—*Quercus.*
277. **Junovidov, A. P.** Kasahsky Forestry Institute, Shtchuchje, Kokchetav Region, Kasahskaja SSR, Russia. PH, TG—General, *Pinus.*
278. **Jurriaanse, Aart.** Department of Forestry, Research Division, D. R. de Wet Tree Breeding Station, P. O. Box 162, Sabie, Transvaal, Union of South Africa. BM, CY, HG, SE, TG—*Pinus.*
279. **Kadambi, K.** (Cf. No. 24). WG—*Pinus.*
280. **Kairov, I. A.** (Cf. No. 55). PE—General.
281. **Kalinina, I. V.** Experimental Station VNIALMI, Kamyshin, Stalingrad Region, Russia. HG, TG—*Juglans, Fraxinus, Pinus, Quercus.*
282. **Kalmykov, S. S.** Bostandyk Experimental Field, Village of Khojikent, Bostandyk District, Tashkent Region, Russia. FR, HA—*Juglans.*
283. **Kanak, Karel.** (Cf. No. 124). BM, FL, PH, ST, VA—*Pinus.*
284. **Kang, Ke W.** (Cf. No. 4). DR, IR, ST—*Pinus, Populus.*
285. **Kanitz, H. B.** Staatliches Lehrforstamt Bramwald, (20b) Hemeln über Hann. Münden, West Germany. BW, PR—*Quercus.*
286. **Kantor, J.** (Cf. No. 88). BM, DR, HG, PE, SI, SO—*Betula*; HG—*Sorbus*; BM—*Abies.*
287. **Kaplan, J.** Forest Department J. N. F., Dear Harei Jehuda, Eshtael, Israel. IE, VC—*Eucalyptus, Pinus.*
288. **Kariyone, Tatsuo.** National Hygenic Laboratory, Yoshida-konoecho, Sakyo-ku, Kyoto, Japan. FO (chemicals), TA—*Pinus.*
289. **Kärki, Lauri E. P.** (Cf. No. 219). GI, SC, SL, SO, SS, VG—General; BM, HG, SE, SO—*Pinus, Picea, Betula, Larix, Alnus, Populus, Fraxinus, Quercus.*
290. **Karl, J.** Forstamt Dillingen, Dillingen, a.d. Donau, West Germany. CF, VA—*Pinus.*
291. **Karnatz, H.** Obstbauversuchsanstalt der Landwirtschaftskammer Hannover, in Jork, Bez. Hamburg, West Germany. HA—General, fruit trees.
292. **Karpati, Istvan.** Magyar Tudomanyos Akademia, Botanikai Kutató Intézete, Vácrátót, Hungary. CO, FO, RA, TA—*Fraxinus*; PH—*Betula, Fagus.*
293. **Karpati, Verona.** (Cf. No. 292). FO, RA, TA—*Fraxinus.*
294. **Karpati, Zoltan.** Kertészeit és Szölészeti Föiskola, Növénytani Tanszéke, ménesi-ut 44, Budapest, XI, Hungary. FO, TA VA—*Fraxinus.*
295. **Karschon, R.** State of Israel, Ministry of Agriculture, Forest Research Institute, Ilanoth P. O. B 88, Nathanya, Israel. HR, IE, VC *Eucalyptus*; SG, TR, VA—*Pinus*; IE, ST—*Populus*; HR, SG—*Acacia.*
296. **Kato, Y.** (Cf. No. 210). IN—*Cryptomeria.*
297. **Kawagoe, H.** Okayama Agricultural Experiment Station, Okayama, Japan. HG, PC, PH, PO—*Castanea.*
298. **Kawana, Arika.** Tokyo Nogyo Diagaku, Faculty of Agriculture, Hutyu, Tokyo, Japan. FO, VC, VP—*Cryptomeria*; SG, VC—*Pinus.*
299. **Kayacik, Hayrettin.** (Cf. No. 81). PH—*Quercus, Fagus, Tilia, Platanus, Celtis.*
300. **Kazartsev, Ivan A.** (Cf. No. 255). NU, ST—Nut trees; ST—*Populus.*
301. **Kazaryan, V. O.** Armenian Academy of Sciences, Botanical Institute, Erewan, Russia. VC, VP—*Populus, Salix, Elaeagnus.*
302. **Kedharnath, S.** (Cf. No. 24). BM—*Tectonia*; HG—*Pinus*; DR—*Santalum.*
303. **Keiding, Henrik.** (Cf. No. 51). SO—General; BM, HG, RE—*Hevea, Tectonia*; BM—*Fagus.*
304. **Keng, Hsuan.** National Taiwan University, Taipei, Taiwan, China. GG, TA—General.
305. **Kennedy, D.** New Zealand Forest Service, Forest Research Institute, Wellington, New Zealand. IE—*Pinus.*
306. **Kennedy, R. W.** (Cf. No. 9). PQ—*Populus*; WG—*Alnus.*
307. **Kerényi, E.** (Cf. No. 120). BM—General.
308. **Khan, Ashan U.** Divisional Forest Officer's Office, Silvicultural Research Division, 6-D Modal Town, Lahore, West Pakistan. BM, HA, HY, SE—*Acacia.*
309. **Khan, Muhammad I.** Conservator of Forests, Thal Forest Circle, 79-A Block, Satellite Town, Sargodha, West Pakistan. GG—General; IE—*Eucalyptus*; CY, HN, IE—*Acacia.*
310. **Khoshoo, T. N.** Panjab University, Department of Botany, P. O. Khalsa College, Amritsar, India. CY—*Pinus, Cedrus, Picea, Abies, Cunninghamia, Taxodium, Actinostrobus, Callitris, Widdringtonia, Tetraclinis, Biota, Thuja, Cupressus, Juniperus, Podocarpus, Cephalotaxus.*
311. **Kiellander, Carl L.** (Cf. No. 271). BM, HA, PH, PL, SC, SO, ST, TG, VA, VG—*Picea*; BM, HG, PR, SO, TG, VC—*Larix*; SO—*Pinus*; BM, TG—*Pseudotsuga.*
312. **Kim, Chung S.** (Cf. No. 4). CT, PL, SO, ST, VG—General.
313. **Kimura, Arika.** Tôhoku University, Sendai, Japan. EV—General; HN, TA—*Salix, Salix* hybrids.
314. **Kimura, Chugai.** (Cf. No. 313). EM—*Populus.*
315. **Kindt, S. Gisselfeld,** Haslev, Denmark. IE, PR—*Picea.*
316. **Kirkman, Peter A.** (Cf. No. 278). BM, CV, HG, ST, TG, VG—*Pinus, Populus, Eucalyptus.*
317. **Klauditz, Wilhelm.** Technische Hochschule Braunschweig, Institut für Holzforschung, Bienroder Weg 53, Braunschweig-Kralenriede, West Germany. PQ, WQ—*Populus.*
318. **Kleinschmit, Richard.** Lehrforstamt Escherode, Escherode über Hann. Münden, West Germany. FE, SO, VC—General; BH, GR, HE, TE—*Larix*; VG—*Pinus, Picea, Pseudotsuga, Fagus.*
319. **Kloot, Nigel H.** (Cf. No. 100). BA, WQ—*Eucalyptus.*
320. **Knapp, W.** Baden-Würtembergische Forstliche Versuchs- und Forschungsanstalt, Fasanengarten, (14a) Stuttgart-Weilimdorf, West Germany. HP, TR—*Populus.*
321. **Knezevic, I.** Sumarija, Osijek, Yugoslavia. ST—*Populus.*
322. **Knudsen, M. V.** Teknologisk Institut, Hagemannsg. 2, Copenhagen V., Denmark. GR, PQ, PR, WG, WQ—*Picea.*
323. **Knyazev, Vladimir P.** (Cf. No. 125). BM, SE—*Pinus.*
324. **Kociecki, Stefan.** (Cf. No. 41). SC, SG—General; VA—*Larix.*
325. **Konar, R. N.** (Cf. No. 272). EM, PO, SG—*Pinus*; EM, FL—*Ficus.*
326. **Konovalov, N. A.** Ural 'sky Forest Technical Institute, Sverdlovsk, Russia. HA, HG, TG—*Populus.*
327. **Kootz, F. W.** Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, Institüt für Forstwissenschaften Eberswalde, Zweigstelle Waldsieversdorf, Aussenstelle Bad Doberan, East Germany. SO—General; SG—*Pinus.*
328. **Kopecky, Ference.** Erdészeti Tudományos Intezet, Nyárfakutató Kisérleti Allomása, Sárvár, Hungary. BM, HG, HP, HS, TR, VC—*Populus*; BM, FL, PC—*Robinia*; BM—*Salix.*
329. **Kormilintsin, A. M.** (Cf. No. 16). IE—General.
330. **Koslenko, G. M.** Br'ansk Forestry Institute, Br'ansk, Russia. TG—General.
331. **Kotelova, Nataliya B.** Moscow Forest Technical Institute, Stantsiya Stroitel Mytishchkogo District, Moscow Region, Russia. BM, SE—*Pinus.*
332. **Kotyukov, Arkandy E.** (Cf. No. 125). BM, PH, ST—*Quercus.*
333. **Kotze, J. J.** c/o South African Pulp and Paper Industries Ltd., P. O. Box 10246, Johannesburg,

Union of South Africa. IE—*Eucalyptus.*

334. **Kovalovsky, D.** Arborétum Slovenské Akademie Vêd, Mlynany, Czechoslovakia. BM, VG—*Quercus.*

335. **Krahl-Urban, Joachim.** (Cf. No. 285). BM, DR, FO, GI, GR, PH, PR, SF, ST, SW, VA, VG—*Quercus*; BM, GI, ST, VA, VC—*Fagus.*

336. **Krstic, M.** (Cf. No. 276). DR, HG—*Castanea*; DR—*Populus*; SG, SP—*Pinus.*

337. **Krumbiegel-Richter, Brigitte.** Klara-Zetkin-Strasse 16, Halle/Saale, East Germany. FL—*Juglans, Corylus.*

338. **Kudasheva, Raisa F.** (Cf. No. 255). BM, SE—*Corylus, Larix,* "Brickwood." "Violet Amur."

339. **Kujala, Viljo.** (Cf. No. 219). DR, TA, VA—General; TA—*Betula.*

340. **Rundzinesh, Artur.** Academy of Sciences, U.S.S.R., Institute of Problems of Forest Economy, Smilshu Street 1, Riga, Latvian SSR, Russia. BM, SE—*Ulmus.*

341. **Kunimura, N.** Saikyo University, Faculty of Agriculture, Shimogamo, Kyoto, Japan. FR, PO, SI—*Asimina.*

342. **Kuppuswami, B. S.** Agricultural Research Institute, Horticultural Section, Coimbatore, India. FL, FR—*Juglans.*

343. **Kurata, Takashi.** Japan Monopoly Corporation, Camphor Experiment Station, Shimo-ishiki-cho, Kagoshima, Japan. BW, SE—*Cinnamomum.*

344. **Kurth, Alfred.** (Cf. No. 38). SC, SL—General.

345. **Kuznetsova, Valentina I.** Steppe Forest Selection Experiment Station, P/O Meshcheskoe, Balynskogo District, Lipetskoi Region, Russia. IE—General.

346. **Laffers, Anton.** Slovenská Akadémia vied Botanická Záhrada v Kosiciach, Košice, Komenskeho 67. Czechoslovakia. BM, GG—General; HA, IE—*Juglans.*

347. **Laing, E. V.** University of Aberdeen, Department of Forestry, Aberdeen, Scotland. FO, TA—*Pinus*; FO, HN—*Betula*; HN—*Abies*; FO—*Pseudotsuga*; CO, EM, HY—*Larix.*

348. **Lakhandal, R. N.** Birbal Sahni Institute of Paleobotany, Lucknow, India. PO—*Picea.*

349. **Langhammer, Aage.** (Cf. No. 59). BM, DR, HG—*Populus.*

350. **Langlet, Olof.** (Cf. No. 5). FO, IE, PR, SE, SI, SL, SS, ST, TR, VA—*Pinus, Picea.*

351. **Langner, Wolfgang.** (Cf. No. 245). BM, CT, EX, GG, GI, HE, IE, MU, NT, PC, PD, SC, SL, SO, VC, VG—General; BM, DR, HG, HP, PR—*Larix*; FO, HS, PR, SI, TE, TG—*Picea.*

352. **Lantelmé, Wilhelm.** Industriestrasse 2-4, Duderstadt, West Germany. SO—General.

353. **Larcher, Walter.** Universität Innsbruck, Institut für Botanik, Sternwartstrasse 15, Innsbruck, Austria. HA, PS—*Pinus, Cedrus, Cupressus, Quercus, Laurus, Olea,* etc.

354. **Larsen, Egon.** (Cf. No. 27). BM, IE, PR, SO, ST, TE, VC—*Pinus*; IE, PR—*Pseudotsuga, Larix.*

355. **Lazarescu, Const.** (Cf. No. 40). HG, HN, PC, VG—*Quercus*; CO, HG, HP, PC, PH, VG—*Fraxinus*; HG—*Juglans*; ST—*Robinia.*

356. **Lee, Tchang B.** Seoul National University, College of Agriculture, School of Forestry, Suwon, Kyunggido, Korea. CY, HG—*Quercus.*

357. **Legachev, Ivan N.** Pepovskaya Forest Experiment Station, ST Puzevo Boronezhskoe District, Russia. BM, SE—*Pinus.*

358. **Legault, Albert.** Université de Montréal, Service de Biogéographie, 2900 Boulevard du Mont Royal, Box 6128, Montréal 3, Quebec, Canada. PD, PO—*Picea, Pinus, Betula.*

359. **Lehotsky, L.** Ceskoslovenská akademie zemědělskych vêd, Vyzkumny ústav lesního hospodárstvi, Banská Stiaynica, Czechoslovakia. SO—General; BM—*Pinus.*

360. **Leibundgut, Hans.** Eidgenössische Technische Hochschule, Zürich, Switzerland. PD—General; FE, SG, SW, TR—*Picea*; VA—*Fraxinus*; TR, VA—*Pinus*; BM, DR, HG, TG—*Populus, Salix.*

361. **Leinonen, Pentti.** State Forest Service, Unioninkatu 40 A Helsinki, Finland. SC, SL, SO, SS, ST—General.

362. **Leman, V. M.** Timiryazev Agricultural Academy, Moscow, Russia. TR—*Pinus Salix,* "Siberian Cedar."

363. **Lemoine, Michel.** (Cf. No. 62). BM, HG, TG—General; PR—*Picea*; BM, ST—*Populus*; SG, VA—*Larix.*

364. **Leonardis, Rosario F. J.** Diagonal Norte 938, Piso 5°-Capital, Buenos Aires, Argentina. IE, NT—*Populus.*

365. **Lepage, E.** Ecole d'Agriculture, Rimouski, Quebec, Canada. HN—*Betula.*

366. **Leredde, C.** (Cf. No. 147). EM—General.

367. **Leskinen, Usko.** (Cf. No. 219). NT, SC, SO, VG—General.

368. **Leyton, Leonard.** (Cf. No. 111). FE, NT, PS — General, *Picea, Larix, Pinus.*

369. **Lichte, H. F.** Staatsinstitut für Allgemeine Botanik, Jungiusstrasse 6, Hamburg 36, West Germany. PO—General.

370. **Liljefors, Alf.** Åsbacken 35, Bromma, Sweden. CY, EM, HY, NT, PO, TG—*Sorbus, Sorbus* hybrids.

371. **Lin, Wei-fang.** Taiwan Forest Research Institute, Taipei, Taiwan, China. PS, TR—*Chamaecyparis.*

372. **Lindquist, Bertil.** Göteborgs Botaniska, Trädsgärd, Frölundagatan 22, Göteborg C, Sweden. CT, CV, GG, SO, ST, VA—General; TA, VA—*Picea*; BM, WG—*Betula*; PR, VA—*Larix*; BM, VA—*Quercus.*

373. **Lines, R.** (Cf. No. 128). BH, PR, TE—*Larix*; PR—*Pinus, Pseudotsuga.*

374. **Linzon, S. N.** (Cf. No. 106). DR, PS—*Pinus.*

375. **Liyanage, Don V.** (Cf. No. 2). BM, NU, SE, SG, TE—*Cocos.*

376. **Ljunger, Ake.** (Cf. No. 271). CT, CV, SO, ST, VG—General (conifers); BM, CY—*Alnus, Quercus*; BM, CY, SO, ST, VG—*Fagus.*

377. **Lofting, E.** Det Forstlige Forsøgsvaesen i Danmark, Bybaek per Vejle, Denmark. PR—*Abies.*

378. **Loken, Asbjorn.** Vestlandets forstlige forsøksstasjon, Zetlitzgt. 1, Stend per Bergen, Norway. SG—General; CY—*Betula.*

379. **Longman, K. A.** University College of Wales, Aberystwyth, Wales. IN, SO—*Larix.*

380. **Loock, E. E. M.** Department of Forestry, Forest Research Branch, Agricultural Buildings, Hamilton Street, P. O. Box 334, Pretoria, Union of South Africa. RA, TA, VA—*Pinus.*

381. **Lücke, H.** Forstamt Harsefeld, Harsefeld Bez. Hamburg, West Germany. BH, ST, VG—*Pinus, Larix*; SO—*Populus.*

382. **Luckwill, Leonard C.** University of Bristol, Research Station, Long Ashton, Bristol, England. FR, IN, PS, SG, VP—General, fruit trees.

383. **Lundberg, Jorgen.** Mogensgade 38, Viborg, Denmark. PR—*Pseudotsuga.*

384. **Lundén, R.** (Cf. No. 224). PO—General; PE, PO—*Alnus, Pinus.*

385. **Lyr, Horst.** Humboldt-Universität, Berlin, Forstwirtschaftliche Fakultät, Institut für Forstbotanik, Schwappachweg 2, Eberswalde, East Germany. DR, PR, PS—*Pseudotsuga, Populus.*

386. **Lyubavskaya, A. Y.** (Cf. No. 331). FL, FR, ST—*Betula.*

387. **McNeill, W. M.** (Cf. No. 347). FR, SA—*Pinus.*

388. **McWilliam, J. R.** Commonwealth Scientific and Industrial Research Organization (C.S.I.R.O.)., Division of Plant Industry, Canberra, A.C.T., Australia. BH, CY, EM, HY, PC, PD, PE, PO, SA, SF, SI, SO, ST—*Pinus*; ST—*Araucaria, Agathis.*

389. **MacGillivray, Hugh G.** Department of Northern Affairs and National Resources, Forestry Branch, Fredericton, New Brunswick, Canada. HG, IE, IR, PC, ST, VG—*Abies;* IE, ST, VG—*Picea;* PR—*Pinus.*

390. **Machado, D. Periera.** Ministerio da Economia, Secretaria de Estada da Agricultura, Direcçao Geral dos Serviços Florestais e Equicolas, Avenida Engenhiero Duarte Pacheco, 124, Lisboa, Portugal. RE, ST, VP—*Pinus.*

391. **Maeda, Chiaki.** Hyogo Forest Experiment Station, Yamasaki-cho, Shisoo-gun, Hyogo Prefecture, Japan. ST, VC—General.

392. **Maggs, D. H.** (Cf. No. 171). IN, PS, VP—General, fruit trees.

393. **Magini, Ezio.** (Cf. No. 78). BM, HG, HS, PE, SG, SI, ST, TE, VC—*Pinus.*

394. **Mangieri, Héctor.** Administración Nacional de Bosques, Azcuénaga 1344, Buenos Aires, Argentina. IE, NT—*Eucalyptus.*

395. **Manzhos, Anna M.** (Cf. No. 125). CO—General; PE—*Pinus.*

396. **Marcet, Enrique.** (Cf. No. 360). PD—General; PD, VA—*Pinus;* BM, DR, HG, PH, SC, SG, TA—*Populus;* BM, HG, TG—*Salix.*

397. **Marquardt, Hans.** (Cf. No. 32). CT, CV, CY, GG, SO, ST, TG—General; DR—*Pseudotsuga;* BM, PS, VA—*Populus.*

398. **Marsh, E. K.** (Cf. No. 380). IE, WG—*Pinus.*

399. **Martin Bolanos, M.** (Cf. No. 19). TA, VA—*Pinus.*

400. **Martinez, Maximino.** Universidad Nacional Autonoma, Instituto Bio-

logia, Mexico City, Mexico. RA, TA, VA—*Pinus.*

401. **Martinez-Mata, Florentino.** (Cf. No. 19). BM, DR, HG, PR, SE, TG—*Populus, Salix, Castanea, Pinus.*
402. **Mathur. R. N.** (Cf. No. 24). IR—*Tectonia.*
403. **Matskevich, Nataliya B.** (Cf. No. 125). PL—General.
404. **Matsui, Zenki.** Ministry of Agriculture and Forestry, Forestry Agency, Government Forest Experiment Station, Hokkaido Branch, 13 Avenue, 5 Street, Toyohira, Sapporo, Japan. IE, SA—General.
405. **Matsumoto, Yoshitomo.** Tottori Forest Experiment Station, Tottori, Japan. SE—General.
406. **Matsuura, Takashi.** (Cf. No. 404). FR, SG—*Abies;* SG—Picea, *Larix, Robinia, Cytisus.*
407. **Matsuzaki, Shozaburo.** (Cf. No. 404). FE, IN—*Latrix.*
408. **Matthews, John D.** (Cf. No. 74). BM, CT, FE, GG, HE, IE, IN, PC, PH, SC, SE, SL, SO, ST, TE, VC, VG—General; FR, IN, SO, ST, TE, VG—*Pinus;* CO, FL, HG, HP, IN, PH—*Larix,, Larix* hybrids; FR, PH, VG, VP—*Fagus;* FR—*Sequoia;* DR—*Thuja.*
409. **Mattos, H. P. S. de.** Serviço Florestal, Seção de Silvicultura, Riox Gardin Botanico-1008, Rio de Janeiro, Brazil. PH—General.
410. **Matyas, V.** Erdömérnöki Föiskola, Dóczi L. ut 6, Sopron, Hungary. PR, SW—*Pinus;* FR, SC—*Quercus.*
411. **Maurin, A. M.** (Cf. No. 55). PE—*Larix, Pinus, Pseudotsuga, Acer, Betula, Phellodendron, Tilia.*
412. **Mayer-Krapoll, Hermann.** Ruhr-Stickstoff AG, Königsallee 21, Bochum, West Germany. FE—General, *Pinus, Picea, Abies, Fagus, Quercus, Fraxinus.*
413. **Mehra, P. N.** (Cf. No. 310). CY—*Abietaceae, Cupressaceae, Taxaceae, Taxodioceae, Podocarpineae, Gnetaceae.*
414. **Meiden, H. A. van der.** (Cf. No. 191). DR, FE—*Populus.*
415. **Mejorada, Norberto S.** Tiziano 184.-Col. Alfonso XIII, Mixcoac, México 19, D. F., Mexico. RA, TA—*Abies, Pinus.*
416. **Melville, R.** Royal Botanic Gardens, Kew, Surrey, England. FO, HN, TA—*Ulmus, Ulmus* hybrids.
417. **Messer, H.** Staatsdarre Wolfgang, Wolfgang Krs. Hanau/Main, West Germany. FL, SC, SG, SL—General; SG—*Picea, Tilia, Carpinus, Fagus, Pseudotsuga, Pinus;* FR—*Abies.*
418. **Meyer, H.** Staatliches Forstamt Rotenburg, Rotenburg bei Hamburg, West Germany. DR, HG, HP, PE, PR—*Pinus;* BM, DR, NT, PR, SC, SG—*Pseudotsuga;* HP—*Populus, Betula;* PR—*Picea.*
419. **Meyer-Uhlenried, K.-H.** (Cf. No. 32). CT, HG, PQ—*Populus.*
420. **Miegroet, P. van.** Rijkslandbouwhogeschool, Coupure Links 233, Gent, Belgium. FO, TA—*Populus.*
421. **Migita, Kazuo.** Nagoya University, Faculty of Agriculture, Anjoshi, Aichi Prefecture, Japan. IN, PE, SG, VC—*Cryptomeria;* SG—*Pinus.*
422. **Miki, Shigeru.** Osaka City University, Institute of Polytechnics, Biological Department, Osaka, Japan. CY, EV—General, *Pinus, Pinaceae, Taxodiaceae.*
423. **Milkowska, A.** Department of Microbiology, Czysta 18, Kraków, Poland. FO, VA—*Ulmus.*
424. **Minina, Elena G.** (Cf. No. 125). FL, FR—*Quercus.*
425. **Minshall, W. H.** Department of Agriculture, Research Branch, Pesticide Research Institute, University Sub-Post Office, London, Ontario, Canada. PD, PH—*Pinus, Acer, Ulmus.*
426. **Mirdamadi, Esmail.** Ministry of Agriculture, Forest Service (Bongah Djangalha), Meydan Ferdowsi, Tehran, Iran. BM—*Populus.*
427. **Misnik, G. E.** Kuibyshevsky Agricultural Institute, Kinel', Russia. PH—General.
428. **Mitchell, Alan F.** (Cf. No. 74). CT, IN, PC, PH, SL, ST, TE, VC, VG—General; HG, IN, VG—*Larix;* FR—*Sequoia;* ST—*Picea.*
429. **Mitscherlich, Gerhard.** (Cf. No. 32). FE—General; IE—*Quercus.*
430. **Mittre, Vishnu.** (Cf. No. 348). PO—*Gymnospermae.*
431. **Miyake, I.** (Cf. No. 210). IN—*Cryptomeria.*
432. **Moffett, Alan A.** University of Natal, Wattle Research Institute, P. O. Box 375, Pietermaritzburg, Natal, Union of South Africa. BM, BW, DR, FO, GR, HE, HG, HP, SE, TG—*Acacia.*
433. **Molina-Rodriguez, Fernando.** Ministerio de Agricultura, Direccion General de Montes, Caza y Pesca Fluvial, Instituto Forestal de Investigaciones y Experiencias, Apartado 127, Pontevedra, Spain. GG, PR, RE, ST, VG—*Pinus.*
434. **Möller, Carl Mar:** Den Kgl. Veterinaer- og Landbohøjskole, København V., Denmark. FE—*Picea, Fraxinus, Alnus, Fagus.*
435. **Molnar, A. C.** (Cf. No. 96). IE—General.
436. **Moone, D.** Forest Department, Long Circular Road, Port of Spain, Trinidad, British West Indies. GR, SF, ST—*Tectonia.*
437. **Moore, R. J.** (Cf. No. 238). GG—General; CY, MU, PL, TA—*Caragana.*
438. **Morandini, Ricardo.** (Cf. No. 8). SA, SL, SS—*Abies, Picea, Pseudotsuga, Cupressus, Cedrus;* PR, SA, SL, SS, ST—*Larix;* SA, SL, SS, ST, VA—*Pinus.*
439. **Moritz, Otto.** (Cf. No. 175). HY, TA—General.
440. **Mork, E.** (Cf. No. 1). PR, SG—General; CO, FR, PH, SC, SG—*Pinus.*
441. **Morrison, Frank T.** New Zealand Forest Service, Waipoua Forest, P. B. Dargaville, Northland, New Zealand. HG, HS, NT, PC, ST, VA, VC—*Agathis.*
442. **Moss, E. H.** (Cf. No. 270). HN—*Pinus.*
443. **Moulds, Frank R.** Victorian School of Forestry, Creswick, Victoria, Australia. FE, IN—*Pinus.*
444. **Mroczkiewicz, Leon.** High School of Agriculture, Faculty of Silviculture, Wojska Polskiego 69, Poznan, Poland. GI—General; BM, IE, ST—*Salix.*
445. **Muhle Larsen, C.** Union Allumettière, S. A., Institute de Populiculture, 230 Rue Buizemont, Grammont, Belgium. CV, FO, IN, TA, VA, VC—*Populus;* VC—*Picea.*
446. **Mühlethaler, K.** (Cf. No. 360). PO—*Pinus, Alnus, Corylus, Fagus, Quercus.*
447. **Mukherjee, Sunil K.** Office of the Deputy Director of Agriculture, Writers Building, Calcutta (West Bengal), India. CY, FO, HN, PO—*Mangifera.*
448. **Müller, R.** Forschungsinstitut für Pappelwirtschaft, Kaiserstrasse 29, Brühl b. Köln, West Germany. CT, CV, DR, PH, TA—*Populus.*
449. **Muntzing, Arne.** (Cf. No. 208). CY, PL—*Populus.*
450. **Murai, Saburo.** Tohoku Forest Tree Improvement Station, Takizawa-mura, Iwate, Japan. ST, VC—General; PR—*Pinus;* BM, SE—*Populus, Salix, Betula, Alnus.*
451. **Murray, J. S.** (Cf. No. 74). DR—*Pinus, Ulmus.*
452. **Mushegjan, A. M.** State Botanical Garden, Alma-Ata, Russia. IE—General.
453. **Muto, Kenyu.** Hokkaido University, Faculty of Agriculture, Sapporo, Japan. PE—*Salix, Alnus, Betula.*
454. **Myczkowski, S.** Polska Akademia Nauk, Institute of Protection of Nature, Ariánská 1, Kraków, Poland. BH, CF—*Picea.*
455. **Nadasi, M.** (Cf. No. 120). BM—General.
456. **Naess-Schmidt, Keld.** East Sjaelland Forest Tree Improvement Association, Bregentved per Haslev, Denmark. SC, VG—General; BM, DR, HG, IR—*Quercus, Fraxinus, Picea, Acer, Fagus, Larix, Thuja;* VG, VP—*Pseudotsuga.*
457. **Nair, P. K. K.** (Cf. No. 348). PO—*Picea.*
458. **Nakahira, Kosuke.** Ministry of Agriculture and Forestry, Forestry Agency, Government Forest Experiment Station, Kôchi Branch, Kôchi, Japan. HS, PL—*Edgeworthia.*
459. **Nakamura, Kentaro.** Komagomekamifujimae-cho, Bunkyo-ku, Tokyo, Japan. FR, GR, SE, ST, TE, TG—*Cryptomeria;* HG—*Pinus.*
460. **Narita, Yoshizo.** Kôchi Agricultural Experiment Station, Befu Branch, Takaokagun, Kôchi Prefecture, Japan. CY, VC, VP—*Broussonetia.*
461. **Negisi, Ken-itiroo.** (Cf. No. 184). DR, PS—*Pinus, Cryptomeria;* VC—*Populus.*
462. **Nekrasov, Valery I.** (Cf. No. 125). IE, SE—General.
463. **Nekrasova, Tamara P.** Sibirsky Filial Akad. Nauk., Biological Institute, Michrina Street 20, Novosibirsk, Russia. SG, SO—General; FL, PO, TG, VA—*Pinus.*
464. **Nel, Paul M.** (Cf. No. 278). BM, CY, SE—*Pinus.*
465. **Neugebauer, W.** i. Fa. Pein & Pein, Neuhäsel/Westerwald b. Montabaur, West Germany. IE—General; HA—*Pseudotsuga.*
466. **Nicholls, J. W. P.** (Cf. No. 100). PQ, WQ—General.
467. **Nielsen, Poul C.** (Cf. No. 51). IE—General; FL, HG, PC, PH—*Fagus.*
468. **Nikles, Donald G.** Queensland Department of Forestry, Forest Research Station, Beerwah, Queensland, Australia. HG, SF—*Araucaria, Agathis;* DR, HG, SF—*Pinus.*

469. **Nilsson, Bo.** Föreningen Skogsträdsförädling, Brunsberg, Sweden. BH, FE, FR, GR, SA, SO, VG—*Pinus;* GR, HA, PH, TE—*Picea;* HG, HP—*Larix.*
470. **Nishimura, Satsuki.** Miyazaki University, Faculty of Liberal Arts and Education, Department of Biology; Miyazaki, Japan. MU—General; IE—*Sequoia;* PL—*Pinus;* HA—*Acacia.*
471. **Nixon, Kathleen M.** (Cf. No. 432). BM, BW, DR, HG, SI—*Acacia.*
472. **Nohara, Y.** Ministry of Agriculture and Forestry, Forestry Agency, Government Forest Experiment Station, Yamagata Sub-branch, Kamibuti, Mamurogawa, Japan. HG—*Pinus.*
473. **Northcott, Philip L.** Department of Northern Affairs and National Resources, Forestry Branch, Forest Products Laboratories, 6620 Northwest Marine Drive, Vancouver 8, British Columbia, Canada. WG—*Alnus, Pseudotsuga, Tsuga, Populus, Pinus, Larix, Abies, Thuja, Salix, Prunus, Ulmus, Araucaria;* WQ—*Thuja, Carya,* etc.
474. **Norskov-Lauritsen, Gunner.** (Cf. No. 278). BM, HG, SE—*Pinus.*
475. **Noskov, Viktor I.** Forest Technical Institute, Voronezh, Russia. BM, SE—*Pinus.*
476. **Nyesterov, V. G.** (Cf. No. 362). FR, GR, TR—*Pinus.*
477. **Ocskay, Suzana.** (Cf. No. 94). CV, HG, ST—*Populus;* HG—*Quercus.*
478. **Ogasawara, Kenji.** Kyoto University, Faculty of Agriculture, Kamigamo Experimental Forest, Sakyoku, Kitashirakawa Oiwake-cho, Kyoto, Japan. CY—General; VC, VG—*Populus;* VC—*Metasequoia, Cryptomeria.*
479. **Okada, Yukio.** (Cf. No. 210). PC, SE—General; DR, PS—*Cryptomeria.*
480. **Okanoue, Masao.** (Cf. No. 210). HA—General.
481. **Oksbjerg, Erik B.** Kungl. Skogshögskolan, Stockholm 51, Sweden. FE, HR, IE, PH, PR—*Picea.*
482. **Okudai, Sigetaka.** Tokai-Kinki Agricultural Experiment Station, Horticultural Division, Okitu, Sizuoka, Japan. IN—*Castanea.*
483. **Ono, Kenji.** (Cf. No. 257). SG, TR—*Chamaecyparis.*
484. **Onozawa, Yasuhiko.** (Cf. No. 184). PO—General; DR—"Mulberry."
482. **Okudai, Sigetaka.** Tokai-Kinki Research Institute of Forestry (NIILKH), Proletarskaya Street Dom 18, Gomel, Russia. NU—General; BM, SE—*Pinus;* HG, TG—*Populus.*
486. **Orr-Ewing, Alan L.** (Cf. No. 150). GI, IE, SL—General; BM, CY, FL, GR, HG, IE, PC, PE, PH, PR, SI, SO, ST, TE—*Pseudotsuga.*
487. **Ortmann, Chr.** Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, Institut für Forstwissenschaften Tharandt, Mitschurinstrasse 18, Bernberg/Saale, East Germany. BM, NT, SG, VA, VC—*Salix.*
488. **Oskarsson, Ole.** (Cf. No. 219). BM, DR—*Populus.*
489. **Osolin, G. P.** Middle Asia Scientific Research Institute of Forestry, Tashkent, Russia. DR—*Ulmus.*
490. **Oudemans, Th. C.** Klein Schovenhorst, Putten (G.), Netherlands. GG—General; PR—*Pseudotsuga.*
491. **Ovington, J. D.** Nature Conservancy, 19 Belgrave Square, London, S. W. 1, England. FE, PS—*Pinus, Betula.*
492. **Ozaki, Kiyoshi.** Shiga Agricultural College, Shiga Prefecture, Japan. PS—General; FE, IN—*Larix.*
493. **Ozawa, Junjiro.** (Cf. No. 210). FE, FR, IN, SG—*Larix;* FL, FR, SG—*Abies;* SG—*Robinia, Cytisus, Picea.*
494. **Ozol, Alfred M.** (Cf. No. 340). BM, IE, SE—*Juglans.*
495. **Ozolin, G. A.** Middle Asia Scientific Research Institute of Forestry, Uzbek SSR, Tashkent, Russia. BM, DR, SE—*Ulmus, Populus.*
496. **Paardekooper, E. C.** The Rubber Research Institute of Malaya, Botanical Division, P. O. Box No. 150, Kuala Lampur, Malaya. CT, PE, RE, TE, VG—*Hevea.*
497. **Pahlen, Eva Konopacki de Von.** (Cf. No. 30). BM—*Populus.*
498. **Paixao-Correia, C. A. de.** Estação de Biologia Florestal, Secção do Sobreiro, Alcobaça, Portugal. IN—*Quercus.*
499. **Panin, Vadim A.** Academy of Sciences, U.S.S.R., West-Siberian Division, Institute of Genetics, Novosibirsk, Russia. BM, SE—*Ulmus.*
500. **Panov, Aleksander.** Institut za naučna šumarska istrazivanja u Sarajevu, Sarajeva, Yugoslavia. SG—General, *Fraxinus, Celtis, Prunus, Tilia.*
501. **Papaionnou, Jean C.** University of Salonika, Forest Faculty, Laboratory of Forest Botany, Salonika, Greece. CO, HN, VA—*Pinus.*
502. **Pavlenko, F. A.** Scientific Research Institute of Forest Economy (NIILKH) Ukrainian SSR, Artema Street 2, Kharkov, Russia. BM, SE—*Corylus.*
503. **Pawsey, Charles K.** Department of Interior, Forestry and Timber Bureau, Mt. Burr Forest Reserve, South Australia, Australia. BM, DR, GR, SF, ST, VG—*Pinus.*
504. **Peace, T. R.** (Cf. No. 74). DR—*Ulmus, Populus.*
505. **Pearsall, W. H.** University College, London, England. EV, PO—General.
506. **Pejoski, B.** Zemlodelsko šumarski fakultet, Skopje, Yugoslavia. RE—*Pinus.*
507. **Perry, D. H.** (Cf. No. 236). IE—*Pinus.*
508. **Persson, Arne.** (Cf. No. 481). DR—General; PD, SL, SO, SS, VA—*Pinus;* DR—*Populus* hybrids; WG—*Betula.*
509. **Petersen, B. Beier.** (Cf. No. 434). IR—*Pseudotsuga.*
510. **Petrescu, Laurentiu.** (Cf. No. 40). GR, HP—*Populus* hybrids.
511. **Petrini, Sven.** (Cf. No. 481). PR—*Pinus.*
512. **Philippis, Alessandro de.** (Cf. No. 78). EM, FR, HG, RE, SG, ST, TE,, VA—*Pinus;* BM—*Populus, Eucalyptus.*
513. **Piatnitsky, Sergei S.** Agricultural Institute, Pushkin Street 81, Kharkov, Russia. BM, PH, SI—*Larix, Acer;* BM, HG, PC, PH, PO, SI—*Quercus.*
514. **Piccarolo, Giacomo.** (Cf. No. 18). BM, DR, GR, HG, PL, SL, ST, VC, WQ—*Populus.*
515. **Pisek, Arthur.** (Cf. No. 353). HA, PS—*Picea, Pinus.*
516. **Pitkänen, Kirsti.** (Cf. No. 121). CY—*Populus, Salix.*
517. **Place, I. C. M.** (Cf. No. 158). BM, GG—General.
518. **Plumridge, A. J.** School of Horticulture, Burnley, Victoria, Australia. SG—General; VG—*Chamaecyparis, Juniperus, Thuja.*
519. **Plym-Forshell, Christina.** (Cf. No. 5). FR, PC, SI—*Pinus.*
520. **Podgorska, J.** Research Centre for Phytocenology, Krakowskie Przedmieście 26/28, Warszawa, Poland, FO, VA—*Fagus.*
521. **Pohl, Zygmut.** (Cf. No. 45). BM, ST, TG—General; BM, FO, HN, HP, PS, RA—*Populus, Populus* hybrids.
522. **Pollock, W. P.** Holmlea, The Mall, Montrose, Angus, Scotland. IE, VA—*Pinus.*
523. **Polozova, Lyudimila Y.** (Cf. No. 125). FL, FR—*Quercus.*
524. **Polster, Hans.** Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, Institut für Fortwissenschaften Tharandt, Zweigstelle Graupa, Bonnewitzerstrasse, Graupa über Pirna/Elbe, East Germany. CT, CV, DR, FO, GR, PS—*Populus, Pseudotsuga, Picea, Pinus.*
525. **Pomerlean, Rene.** Canada Department of Agriculture, Research Branch, Forest Biology Laboratory, % Forestry School, Laval University, Quebec, Quebec, Canada. DR—*Populus* hybrids; DR, MU—*Ulmus.*
526. **Poole, Alick L.** New Zealand Forest Service, P. O. Box 894, Wellington, New Zealand. IE—General.
527. **Porpaczy, Aladar.** Research Institute for Plant Breeding, Fertöd, Hungary. FR, VP—*Juglans;* BM, MU—Small fruits.
528. **Porter, W. A.** (Cf. No. 96). DR—*Pnus, Thuja.*
529. **Pospísil, Jiri.** (Cf. No. 88). BM, DR, HG, HP, HS, VG, VP—*Populus, Fagus, Salix.*
530. **Poulsen, Gunnar.** Forest Office, El-Obeid, Sudan. HN, PR—*Pinus.*
531. **Poynton, R. J.** (Cf. No. 380). IE—*Eucalyptus, Pinus, Populus.*
532. **Prats-Zapirain, Manuel.** Ministerio de Agricultura, Direccion General de Montes, Caza y Pesca Fluvial, Instituto Forestal de Investigaciones y Experiencias, Nunez de Balboa 51, Madrid, Spain. GI—General.
533. **Pravdin, Leonid F.** (Cf. No. 125). IE, SE, SG, VP—General.
534. **Priehäusser, G.** Reg. Amtmann, Bayerischer Wald, Zwiesel/Ost, West Germany. FO, TA, VA—*Picea.*
535. **Probocskai, E.** (Cf. No. 292). BM General.
536. **Prokazin, Evgeny P.** (Cf. No. 255). BM, RE, SE—*Pinus.*
537. **Pryor, Lindsay D.** Canberra University College, Botany Department, P. O. Box 197, Canberra, A.C.T., Australia. BA, BW, FL, FO, GR, HA, HE, HG, HN, HY, TA, TG, VC, WQ—*Eucalyptus.*
538. **Puente, Jose M. De la.** Escuela Nacional de Agricultura, Chapingo, Igual, Mexico. BM, GR, IR, TG—*Pinus.*
539. **Punin, W.** (Cf. No. 285). BW, PR—*Quercus.*

540. **Purcelean, St.** (Cf. No. 40). HG, HN, PC—*Quercus;* SW—*Juglans.*
541. **Puri, G. S.** Botanical Survey of India, Poona, India. IE—General; PO—*Pinus.*
542. **Qosja, Xhafer.** Universiteti Shtetëror i Tiranës, nautchnii sottzudnik, Tiranë, Albania. CO, FL—*Quercus.*
543. **Rack, K.** Niedersächsische Forstliche Versuchsanstalt, Abt. B., Forstschadlingsbekämpfung, Königsallee 221, Göttingen, West Germany. DR, PR—*Quercus, Pinus.*
544. **Rader-Roitzsch, J. E.** Ras Hotel, Addis Ababa, Ethiopia. GR, HP—*Populus* hybrids; SG—*Pinus;* SG, SP—*Quercus.*
545. **Radforth, N. W.** McMaster University, Biology Department, Hamilton, Ontario, Canada. EM, SG—*Pinus, Ginkgo.*
546. **Ragonese, Arturo E.** (Cf. No. 7). DR, HG, HN, IE, MU, NT, PC, PL, ST, TA—*Salix.*
547. **Raizada, M. B.** (Cf. No. 24). GG, TA—General.
548. **Rannert, H.** (Cf. No. 194). IE—*Pinus, Larix, Pseudotsuga, Abies, Quercus.*
549. **Roa, C. Venkata.** Andra University, Waltair (Andra State), India. EM—*Tiliaceae, Bignoniaceae, Palmae.*
550. **Rao, H. S.** (Cf. No. 24). CY, PC—General; VG—*Aesculus;* BM, HG, SE, TG—*Tectonia, Dendrocalamus, Acacia, Terminalia.*
551. **Rattenbury, J. A.** University of Auckland, Botany Department, Auckland, New Zealand. CY—*Elaeocarpus, Araliaceae.*
552. **Rawlings, G. B.** (Cf. No. 27). DR, IE, IR—*Pinus.*
553. **Reginster, Paul.** Ingenieur des Eaux et Forêts de l'Etat, Beauraing, Belgium. SA, SS—General.
554. **Regler, W.** (Cf. No. 56). CV, DR—*Populus.*
555. **Regnier, R.** Museum de Rouen, Rue Dufay, 16, Rouen (Siene Maritime), France. EV, RA, TA—*Populus.*
556. **Reinders-Gouwentak, Cornelia A.** (Cf. No. 67). IN, PS—*Populus.*
557. **Rennerfelt, Erik.** (Cf. No. 5). DR (Rots)—General.
558. **Richardson, S. Dennis.** (Cf. No. 347). PS, RO, TR, VP—*Acer;* SG *Quercus, Pseudotsuga.*
559. **Richens, R. H.** Commonwealth Agricultural Bureaux, Commonwealth Bureaux of Plant Breeding and Genetics, School of Agriculture, Downing Street, Cambridge, England. GG—General; FO, TA, VA—*Ulmus.*
560. **Richtar, Bohuslav.** (Cf. No. 88). BM, FL, HS, PC—*Ulmus,* SG, TR—*Larix, Picea, Pinus, Alnus, Betula.*
561. **Robak, Hakon.** (Cf. No. 378). GR, TR—*Abies, Picea, Pseudotsuga, Tsuga;* GR, TR, VA—*Larix.*
562. **Rocha-Garcia, German de la.** Ministerio de Agricultura, Departmento de Horticultura y Fruticultura, Estacion Experimental Agricola de la Molina, Apartado 2791, Lima, Peru. FE—General, fruit trees; VC, VG—*Carya.*
563. **Rohmeder, Ernst.** (Cf. No. 117). GG, HG, HP, IE, NT, SC, SE, SG, SL, VA, VC—General; DR, PR—*Pseudotsuga;* DR, FR, PR—*Pinus;* PR—*Picea.*
564. **Rohmeder, Marion.** (Cf. No. 117). GG—General; FR, SG—*Pinus.*
565. **Röhrig, E.** (Cf. No. 34). PR, SF, VA—*Pinus;* GR, SE—*Populus* hybrids.
566. **Rol, René.** (Cf. No. 62). BM, GG, TG—General; PR, SE, ST—*Pinus.*
567. **Rosayro, R. A. de.** Forest Department, Research and Education Branch, Research Laboratory, No. 9, Kew Road, Colombo 2, Ceylon. GG—General; PR—*Tectonia.*
568. **Rossmässler, W.** Hessiche Ministerium für- Ernährung, Landwirtschaft und Forsten, Schlossplatz 2, (16) Wiesbaden, West Germany. SL—General; DR, GR, PR, RA, VA—*Pinus;* DR, PR—*Pseudotsuga, Picea;* PR—*Larix.*
569. **Rovsky, Viktor M.** Scientific Research Institute of Forest Economy (NIILKH), Sredne-Aziatsky, Sverdlova Street 26, Tashkent, Russia. BM, HG, NU, SE, TG—*Juglans;* BM, HG, SE, TG—*Pinus, Populus, Ulmus;* BM, SE—*Quercus.*
570. **Rubanik, V. G.** Academy of Sciences, U.S.S.R., Botanical Institute, Kazakhskoi Division, Alma-Ata, Kazakh, Russia. IE, PH—*Acer.*
571. **Rubbo, Romulo.** Ministerio de Ganaderia y Agricultura, Seccion Forestal, Maldonado, Uruguay. DR, HP, IE—*Populus* hybrids.
572. **Rubner, K.** Forschungsstelle für Forstliche Vegetationskunde, Maximilianstrasse 14, München 14, West Germany. CF, DR, GR, PR, RO, SF—*Pinus;* CF, GR, PR, SF, VA—*Betula, Alnus, Populus, Carpinus;* DR, PR—*Larix;* PR—*Picea.*
573. **Ruden, Tollef.** (Cf. No. 1). GG, PR—General; BH, CO, VA—*Pinus.*
574. **Rudman, Peter R.** (Cf. No. 100). DR (Rots), IR (Termites)—*Eucalyptus, Tectonia, Callitris, Athrotaxis.*
575. **Ruggeri, Cecilia.** (Cf. No. 178). BA, CO, FL, FO—*Eucalyptus.*
576. **Rusanov, F. N.** Usbeksky Bot. Sad., Tashkent, Russia. HR—General, *Tamarix.*
577. **Saarnijoki, Kakari.** (Cf. No. 219). BM, FO, PE, ST, TA, TG, WG—*Betula;* HG, PD, PO—*Larix;* PD, PO—*Populus.*
578. **Saatcioglu, Fikret.** (Cf. No. 81). HG, HP, PC—*Populus;* SG—*Cedrus;* PR, VA—*Pinus.*
579. **Saetersdal, Liv S.** (Cf. No. 378). PR, PS, TR—*Picea.*
580. **Sahni, K. C.** (Cf. No. 24). IE, TA—General; TA—*Gymnospermae.*
581. **Saito, Yuichi.** (Cf. No. 215). FL, HN, PC, PS, SO—*Pinus;* PL, PO—*Cryptomeria;* VC—*Salix.*
582. **Sarfatti, Giacomino.** Università di Bari, Instituto di Botanica, Bari, Italy. EM, FL, FR—*Pinus, Amygdalus.*
583. **Sarkar, Priyabrata.** (Cf. No. 24). BM, DR, HG, IR, SE, TG—General.
584. **Sarvas, Risto.** (Cf. No. 219). BM, GG—General; FR, PD, SC, SG—*Betula, Picea, Pinus;* PL—*Populus.*
585. **Sastri, R. L. N.** (Cf. No. 549). EM—*Tiliacora, Cinnamomum, Litsea.*
586. **Sato, Keiji.** Kyushu University, Faculty of Agriculture, Fukuoka, Japan. MU, PC, ST—General; CS—*Cryptomeria, Robinia.*
587. **Sato, Y.** (Cf. No. 453). PE—*Salix, Alnus, Betula.*
588. **Satoo, Seizaemon.** (Cf. No. 85). VC—*Taxus, Torreya, Larix, Pinus, Thuja, Cryptomeria, Thujopsis, Paulownia.*
589. **Satoo, Taisitiroo.** (Cf. No. 184). FR, GR, HE, HR, PS, SG, ST—*Cryptomeria;* HR, PS, SG—*Pinus, Chamaecyparis;* VC—*Populus.*
590. **Sauer, E.** (Cf. No. 245). BM, FO, HG—*Populus.*
591. **Sawada, T.** Kyoto University, Medical Faculty, Pharmaceutical Institute, Kyoto, Japan. TA—General; FO—(Chemicals).
592. **Scamoni, A.** (Cf. No. 385). FL, HG, PD, PH, PR—*Pinus;* FL, PD—*Abies.*
593. **Schaffalitzky de Muckadell, M.** Erikshaab, Højrup, Denmark. CT, FR, IN, PS, SE, VG—*Fagus;* FE—*Picea.*
594. **Schell, Gerd.** (Cf. No. 117). SO—General.
595. **Schlenker, Gerhard.** (Cf. No. 320). CT, HP, SO—*Populus.*
596. **Schmidt, Helmut.** Bayer. Forstamt, Teisendorf, West Germany. SC, VP—General; VA—*Fagus;* BM, HA, SE—*Picea, Pinus, Abies.*
597. **Schmidt, R. L.** (Cf. No. 150). RA, VA—*Abies.*
598. **Schmidt, Werner.** Diagnostik-Institut Bergedorf, Schlebuschweg 17, Hamburg-Bergedorf, West Germany. BM, EX, GG, HE, TE, VC—General; GR, HG, PR, TR—*Pinus;* PR—*Larix.*
599. **Schmitt, Richard.** Hessische Forsteinrichtungs- und Versuchsanstalt, Moltkestrasse 10, Giessen, West Germany. SA, SC, SO—General; PD, SA, ST—*Pinus;* SA, ST—*Pseudotsuga;* BM—*Picea, Larix, Alnus.*
600. **Schmucker, Th.** (Cf. No. 34). VG—General; PH, SW, VC, VG, WG—*Picea;* PH, SW, VC, VG—*Fagus.*
601. **Schneider, Bernhard.** Hollich 161, Burgsteinfurt i. W., West Germany. PR, VA—*Pinus.*
602. **Schober, Reinhard.** (Cf. No. 34). PR—*Pseudotsuga, Larix.*
603. **Scholz, E.** (Cf. No. 56). BM, MU—*Betula.*
604. **Schönbach, Hans.** Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, Institut für Forstwissenschaften Tharandt, Dippoldiswalderstrasse 33, Tharandt/Sa., East Germany. HA—*Pseudotsuga;* BM, DR, HG, PQ, SO, TR—*Populus, Populus* hybrids; BM, PR, SO—*Picea;* BM, SO—*Pinus.*
605. **Schönborn, Alexander von.** (Cf. No. 117). BM, DR, HA, IE, TG—General; SG—*Fagus.*
606. **Schönhar, S.** (Cf. No. 320). DR—*Populus* hybrids.
607. **Schönnamsgruber, Helmut.** (Cf. No. 320). FE—*Populus, Larix, Robinia, Betula, Fagus, Sequoia, Metasequoia, Abies, Picea, Pinus.*
608. **Schreiber, Max.** Hochschule für Bodenkultur, Gregor Mendelstrasse 32, Wien XVIII, Austria. BA, PR, VA, WQ—*Larix;* VA—*Pinus, Picea.*
609. **Schröck, Otto.** (Cf. No. 56). SO, TR—General; FR, GR, IN, TR, VC—*Pinus;* CT, DR, FO, GR, HN, VA—*Populus;* VC—*Picea, Larix.*
610. **Schrötter, F. W. von.** Ministerium

für Ernährung, Landwirtschaft und Forsten Schleswig-Holstein, Düsternbrooker Weg, Kiel 2, West Germany. SA—General; BH—*Picea;* VA—*Larix, Picea.*

611. **Schubert, Johannes A. O.** (Cf No. 3). PR (Seed); SG, SP—*Abies, Larix, Picea, Pinus, Pseudotsuga, Carpinus, Fagus, Fraxinus, Robinia, Acer, Quercus, Tilia.*

612. **Schütt, P.** (Cf. No. 245). CY, DR, HY, PQ, PR, ST, VG—*Pinus;* HA—*Picea;* BM, DR, HG—*Populus.*

613. **Schütte, Freidrich S.** (Cf. No. 543). IR—*Quercus.*

614. **Sebök, L.** (Cf. No. 294). BM—General.

615. **Seitz, F. W.** (Cf. No. 245). BM, CY, HG, NT, PC, PL, SI—*Populus.*

616. **Sekawin, Michele.** (Cf. No. 18). HS, NT, ST—*Populus.*

617. **Semizoglu, Mehmet A.** Orman Umum Müdürlügü, Yakinsark Karakeilik Enstitüsü, Izmit, Turkey. BM, HG, SE, TG—*Populus.*

618. **Senn, Harold A.** (Cf. No. 238). PS, TR—*Caragana, Betula, Picea.*

619. **Severova, Aleksandra I.** (Cf. No. 125). SE, VG—*Pinus;* SE—"Korean cedar."

620. **Sharma, Arun K.** Calcutta University 35, Botany Department, Cytogenetics Laboratory, Ballygunge Circular Road, Calcutta 19, India. CY—General, *Citrus, Acacia, Cinnamomum, Palmae.*

621. **Shchepotev, Fedor L.** (Cf. No. 502). TR—General; EM, FL, FR, PO, PS—*Juglans.*

622. **Shcherbena, Kira G.** (Cf. No. 125). PS, VA—*Pinus.*

623. **Shershukova, Olga P.** (Cf. No. 125). PL—General.

624. **Shibata, Kenzo.** Tokyo Nogyo Diagaku, Setagaya, Tokyo, Japan. CY—*Chamaecyparis, Cryptomeria, Pinus.*

625. **Shidei, Tsunahide.** (Cf. No. 478). BA, FO, VA, VC, WQ—*Cryptomeria, Metasequoia, Populus.*

626. **Shigemoto, Masaru** (Cf. No. 341). SE—General.

627. **Shim, Sang Y.** (Cf. No. 4). IE, VC, VG—General.

628. **Shimamura, Tamaki.** (Cf. No. 421). CY, EM—*Pinus.*

629. **Shioda, Isamu.** Central Station of Forest Tree Breeding, Kasaharacho, Mito, Japan. PC, VC—General.

630. **Simak, Milan.** (Cf. No. 5). CO, CP, FR, SC, SG, SL, SO, SW, VG—*Pinus;* SC, SO—*Picea;* VA—*Larix.*

631. **Siminovitch, D.** (Cf. No. 238). BA, BW, HA—*Robinia.*

632. **Simura, Takasi.** (Cf. No. 421). CY, SE—General.

633. **Sindelar, Jiri.** (Cf. No. 231). GG, GI—General.

634. **Sipos, E.** Budatétény, Kertészeti Kutatóint, Budapest, Hungary. BM—General.

635. **Sobajima, Y.** (Cf. No. 341). FR, PO, SI—*Asimina.*

636. **Soderberg, E.** (Cf. No. 153). PA, SG—*Pinus.*

637. **Soegaard, Bent F.** (Cf. No. 51). GR, PR, SF, TE—*Larix;* HG, SS, ST—*Pinus;* DR, IR, VG—*Pseudotsuga;* DR—*Thuja.*

638. **Soest, J. van.** (Cf. No. 191). SS, ST—*Pinus;* IE—*Pseudotsuga, Larix, Pinus, Quercus, Betula, Fagus.*

639. **Sokolov, Nikolai O.** (Cf. No. 55). VA—*Betula.*

640. **Sokolov, Sergei Y.** Academy of Sciences, U.S.S.R., Botanical Institute, Leningrad 22, Russia. IE—General.

641. **Spada, A.** Universita Modena, Instituto di Chimica Farmaceutica e Tossicologica, Modena, Italy. PO—*Cedrus.*

642. **Staszkiewicz, J.** (Cf. No. 267). CO, VA—*Pinus.*

643. **Stéfanov, B.** Rue Néophite Rilski, 61, Sofia, Bulgaria. IE, TA—*Populus.*

644. **Stefansson, Eric M.** (Cf. No. 5). CO, IE, NT, SC, SO, VG—*Pinus;* IE, VC—*Abies, Larix, Pseudotsuga, Picea.*

645. **Stern, Klaus.** (Cf. No. 245). BM, EV, HE, SI, SL, SO, TG, VA—General; BM, GR, TE—*Pinus;* DR—*Pseudotsuga;* SW—*Picea;* BM—*Betula.*

646. **Strand, Lars K.** (Cf. No. 59). EX, HE, PD, TE—General.

647. **Sugihara, Yosinori.** (Cf. No. 313). EM—*Cupressus.*

648. **Sugimura, Yoshikazu.** (Cf. No. 458). PR, ST, VC—General.

649. **Sukachev, Vladimir N.** (Cf. No. 125). BM, SE—*Salix.*

650. **Surber, Emil.** (Cf. No. 38). NT, SC, SL—General.

651. **Suszka, Bogdan.** (Cf. No. 45). BM, GG—General; VC—*Populus.*

652. **Swan, H. S. D** Pulp and Paper Research Institute of Canada, 3420 University Street, Montreal 2, Quebec, Canada. GG—General; PS—*Populus* hybrids.

653. **Syrach Larsen, Carl.** (Cf. No. 51). CT, CV, DR, GG, GI, HE, IE, PC, PR, SA, SO, SS, ST, VA, VP—General; HG, PL—*Larix;* FL, FR, PC—*Fraxinus;* FL, PC—*Abies;* RO—*Pinus.*

654. **Szonyi, L.** Erdészeti Tudományos Intézet, Frankel Leó ut 44, Budapest, II, Hungary. IE—General.

655. **Takahara, Suemoto.** (Cf. No. 421). FO, VA—*Cryptomeria.*

656. **Takahashi, Nobukiyo.** Tokyo University Experimental Forest, Yamabe-mura, Sorachi-gun, Hokkaido, Japan. IE, SE—General.

657. **Takenouchi, Makoto.** Tohoku Pulp Company, Forestry Department, Marunouti 1-2, Tokyo, Japan. HN—*Abies.*

658. **Takeuchi, M.** (Cf. No. 184). PO—*Taxus, Torreya, Cephalotaxus, Sciadopitys, Juniperus, Cryptomeria, Sequoia, Taxodium, Pinus, Cedrus, Podocarpus.*

659. **Tamm, Carl O.** (Cf. No. 5). FE—*Pinus, Picea, Betula.*

660. **Tanaka, Kiyoshi.** Hirosaki University, Faculty of Literature and Science, Biological Institute, Hirosaki, Japan. MU, PE, PO—*Pinus;* VC—*Populus, Cryptomeria.*

661. **Tashima, Yoshio.** Kagoshima University, Faculty of Agriculture, Kagoshima, Japan. IN, SG, TR—*Pinus.*

662. **Tatarintsev, A. S.** Michurin Fruit and Vegetable Institute, Michurinsk, Russia. PE—*Malus, Pyrus, Sorbus, Crataegus, Amelanchier.*

663. **Tchernlavski, P.** Institut po Agromelioratzii, Stalingrad, Russia. VA—*Quercus;* FL, VA—*Fagus.*

664. **Templin, E.** (Cf. No. 56). CV, IR—*Populus, Populus* hybrids.

665. **Tesdorff, H.** Aarón Castellanos, Santa Fé—F.G.S.M., Argentina. HG, PC, PE—*Araucaria.*

666. **Teucher, G.** (Cf. No. 56). IR—*Pseudotsuga, Pinus.*

667. **Thulin, Ib J.** (Cf. No. 27). BM, IE, SO, ST, PC, PR, TE, VG—*Pinus;* PR—*Larix;* HA, PR—*Pseudotsuga;* VC—*Agathis.*

668. **Thümmler, K.** (Cf. No. 524). SO—General; PR—*Pinus.*

669. **Tigerstedt, Axel.** Arboretum Mustila, Koria, Finland. HA, HG, IE, VA—Ornamental conifers.

670. **Tigerstedt, Peter.** (Cf. No. 669). HA, HG, IE, VA—Ornamental conifers.

671. **Tirén, Larse.** (Cf. No. 5). FL, FR, PH—*Picea;* SG—*Pinus.*

672. **Tjio, Joe H.** Estacion Experimental de Aula dei, Zaragoza, Spain. CY—*Pinus.*

673. **Toda, Ryookiti.** Ministry of Agriculture and Forestry, Forestry Agency, Government Forest Experiment Station, Kumamoto Branch, Kurokamityoo, Simotatuta 547, Kumamoto, Japan. BH, CF, CT, CV, GR, HE, TE, VC—*Cryptomeria.*

674. **Tompa, Karoly.** (Cf. No. 410). FL—*Tilia.*

675. **Topps, J. H.** Wye College (University of London), Agricultural Research Unit, Near Ashford, Wye, Kent, England. DR, FO, PS—*Taxus* and hardwoods.

676. **Toyama, Saburo.** (Cf. No. 470). HA, HR, PL, ST, TE, VA—*Cryptomeria;* FO, VA—*Broussonetia;* GR, HR, PL, ST—*Pinus;* SG, TA—*Eucalyptus;* CY—*Sapium.*

677. **Tralau, H. W.** Bräunkyrkogatan 56, Stockholm Sö, Sweden. MU, VA—*Picea.*

678. **Tranquillini, W.** Forschungsstelle für Lawinenverbauung, Wilhelm Greilstrasse 9, Innsbruck, Austria. HA, PS—*Pinus.*

679. **Trauninger, W.** (Cf. No. 194). SO, ST, VG—General.

680. **Treschow, C.** Lollikgärd, Holte, Denmark. DR (Root rot); VA—*Picea.*

681. **Truchanowiczówna, J.** (Cf. No. 267). CO, FO—*Betula.*

682. **Turpin, Paul.** Arboretum des Barres, Nogent-sur-Vernisson (Loiret), France. SO, VC, VG—General; VC, VG—*Picea, Pseudotsuga;* PR—*Pinus;* VC—*Populus.*

683. **Tyszkiewicz, Stanislaw.** (Cf. No. 41). SE, SG—General; SE—*Populus.*

684. **Ueno, Jitsuro.** (Cf. No. 422). PO—*Metasequoia, Sciadopitys, Taiwania.*

685. **Urban, S.** Medicinski fakultet, Bioloski Institut, Rijeka, Yugoslavia. FL—*Pinus.*

686. **Urquijo-Landaluze, Pedro.** Instituto Nacional de Investigaciones Agronómicas, Estacion Fitopathologica, Centro de Galicia, La Coruña, Spain. BM, DR, HG—*Castanea.*

687. **Vaartaja, Olli.** Department of Agriculture, Research Branch, Forest Biology Laboratory, University Sub Post Office, Saskatoon, Saskatchewan, Canada. CS, NT, SG, TR—General; TR—*Pinus, Picea, Betula, Alnus;* SG—*Betula, Pinus.*

688. **Vaclav, E.** Ceské vysoké ucení

technické, Lesnická fakulta, 14, Studentská, Praha-Dejvice, Czechoslovakia. FR, HG, PC, PE, SG—*Betula, Alnus.*

689. **Vajcik, V.** Lesní závod, Bratislava, Czechoslovakia. BM, VC—*Populus.*

690. **Vaz, Alcino L. C.** (Cf. No. 390). PR, SG—*Cupressus.*

691. **Vechov, N. K.** VNIALMI, Stalingrad, Russia. HG, TG—General, *Juglans, Pinus, Larix, Phellodendron.*

692. **Veen, J. H. van der** (Cf. No. 67). IN, PS—*Populus.*

693. **Veresin, Mikhail M.** (Cf. No. 475). SO—General; BM, SE, VA—*Quercus, Pinus;* VA—*Larix;* HG—*Populus.*

694. **Vicentic, Milic A.** Chamber for Agriculture and Forestry Serbia, Ul. Kr. Ailutina br. 33/III, Beograd, Yugoslavia. CO, FR, SO, VG—*Pinus;* VG—*Quercus.*

695. **Vidakovic, Mirko.** (Cf. No. 15). CY, FO, RA, TA, VA—*Pinus, Pinus* hybrids.

696. **Vieghofer, Leopold.** (Cf. No. 213). BM, SE, TG—*Populus, Salix.*

697. **Vieitez, Ernesto.** Benito Corbal 52, Pontevedra, Spain. TG, VC—*Castanea.*

698. **Vincent, Gustav.** Ceskoslovenská akademie zemědělskych věd, Vyzkumny ústav lesniho hospodárství, a myslivosti, Vyzkumná stanice Uherské Hradiště 11, -Kostelany, Lipová 43, Brno, Czechoslovakia. BM, GG, HE, SL, SO, ST, TG, TR, VA—General; IN, PR—*Pinus;* IN—*Picea;* VA—*Larix.*

699. **Viro, P. J.** (Cf. No. 219). FE—General, *Pinus, Larix.*

700. **Vloten, Heinrich van.** (Cf. No. 191). DR—*Pseudotsuga;* BM, CT, DR, GR, PC, ST, TE, VG—*Populus;* DR, HP, IE, VG—*Larix;* DR, PR, SL—*Pinus.*

701. **Vojtus, Martin.** Vúlh, pobocka Banská Stiavnica, Vyskumná stanica Gabčikovo, Gabčikovo, Czechoslovakia. GG, GI—General and *Populus.*

702. **Vries, P. G. de.** (Cf. No. 67). IE, PR—General; GR, PR—*Pseudotsuga.*

703. **Vyvyan, M. C.** (Cf. No. 171). PS, VG, VP—Fruit trees.

704. **Wachter, Hubertus.** (Cf. No. 56). FR, HA—*Larix.*

705. **Wagenknecht, E.** Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, Institut für Forstwissenschaften Eberswalde, Zweigstelle Eberswalde, Abteilung Forstflanzenzüchtung, Schwappachweg 3, Eberswalde, East Germany. BA, BH, VA—*Pinus.*

706. **Wang, Tze-ting.** (Cf. No. 304). SG—General; VC—*Chamaecyparis, Cryptomeria.*

707. **Wareing, P. F.** (Cf. No. 379). FE, IN, TR—General; FL, IN, PS, TR—*Pinus;* PS, SG, TR—*Betula;* IN—*Larix;* PS, TR—*Robinia;* VC—*Populus, Fraxinus;* PS, TR, VC—*Acer.*

708. **Wassink, E. C.** Laboratory of Plant Physiology Research, Wageningen, Netherlands. TR—General, *Acer.*

709. **Watanabe, Misao.** (Cf. No. 210). PC, PE, ST—*Pinus.*

710. **Watanabe, Sukenaka.** Tokyo University Experimental Forest, Amatsu-machi, Awa-gun, Chiba Prefecture, Japan. ST, VC—General; NT, SG—*Cinnamomum;* BW, NT—*Acacia.*

711. **Went, J. C.** Instituut voor Toegepast Biologisch, Onderzoek in de Natuur (I.T.B.O.N.) Kemperbergerweg 11, Arnhem, Netherlands. DR, HG—*Ulmus, Ulmus* hybrids.

712. **Weston, G. C.** (Cf. No. 27). IE—General, *Pseudotsuga, Larix, Thuja, Eucalyptus;* FE, IE—*Pinus.*

713. **Wettstein-Westersheim, Wolfgang.** (Cf. No. 213). GG, PR, SO, ST—General; BM, DR, FO, GR, HE, HS, IR, RE, TE, VA—*Pinus;* BH, HA, SO, VC, VG, WG—*Betula;* CV, GR, HG, HP, HS, NT, PC, PL, PS, TA, VC—*Populus, Populus* hybrids; PO, VA—*Larix;* TA—*Alnus;* BM—*Salix.*

714. **Wiersma, J. H.** (Cf. No. 67). TR—General.

715. **Wieser, E. F.** Schulstrasse 12, Reutte in Tirol, Austria. BH, CF, VA—*Pinus.*

716. **Wijeygunawardena, L.** (Cf. No. 146). BM, RE—*Hevea.*

717. **Wilusz, Zdzislaw.** (Cf. No. 45). ST—General; ST, TG—*Pinus.*

718. **Withers, G. B.** (Cf. No. 80). SA, SO—General; PR—*Pinus.*

719. **Wittich, W.** Universität Göttingen, Forstliche Fakultät, Institut für Forstliche Bodenkunde, Mitscherlichstrasse 3, Hann. Münden, West Germany. FE, PS—General.

720. **Wolterson, Jacobus F.** (Cf. No. 191). BM, HG, SE, TG—*Pinus, Larix, Pseudotsuga, Populus, Quercus, Liriodendron, Acer.*

721. **Wood, G. H. S.** % Forest Department, Research Station, Sandakan, North Borneo, Indonesia. FL, FR—*Dipterocarpaceae.* (Reported as deceased after numbering of authors in proof.)

722. **Wood, R. F.** (Cf. No. 74). FE—General; PR—*Pinus, Larix.*

723. **Worsley, R. G. F.** (Cf.. No. 74). PE—*Abies, Cedrus, Chamaecyparis, Cunninghamia, Cupressus, Cryptomeria, Larix, Pinus, Picea, Pseudotsuga, Sequoia, Sequoiadendron, Thuja, Tsuga, Taxus.*

724. **Wu, H.** South China Agricultural College, Department of Forestry, Kwanchow, China. FL, PH—*Eucalyptus.*

725. **Yablokov, Aleksandr S.** (Cf. No. 255). BM, ST—*Populus.*

726. **Yamasaki, Noriko.** Keio University, Biological Institute, Yokohama, Japan. CY—*Albizzia.*

727. **Yamazaki, Tugio.** (Cf. No. 252). PO—*Taxodiaceae.*

728. **Yanagihara, Toshio.** Ministry of Agriculture and Forestry, Forestry Agency, Government Forest Experiment Station, Kiso Sub-branch, Hukushima-Mati, Nishitikuma-gun, Nagano Prefecture, Japan. FL—*Larix.*

729. **Yanagisawa, Toshio.** (Cf. No. 404). HG, PH—*Picea;* BA—*Larix;* PH—*Abies, Alnus, Betula, Acer, Ulmus, Quercus, Fraxinus, Juglans, Tilia, Prunus, Sorbus, Magnolia, Kalopanax.*

730. **Yeatman, Christopher W.** (Cf. No. 158). NT, PC, RO—General; TR—*Betula;* BM, DR, GR, HG, PR—*Pinus, Picea.*

731. **Yim, Kyung B.** (Cf. No. 356). ST, VC, VG—General.

732. **Yokoyama, Midori.** Shizuoka Forest Experiment Station, Cro Hamakita-cho, Hamana-gun, Shizuoka Prefecture, Japan. BM, FR, HS, ST, VC—*Cryptomeria;* IR—*Castanea.*

733. **Yokozawa, Yosinori.** Ministry of Agriculture and Forestry, Forestry Agency, Government Forest Experiment Station, Tohoku Branch, Koma, Tamaki-mura, Iwate, Japan. PR—*Pinus.*

734. **Yoshikawa, Katsuyoshi.** (Cf. No. 478). IN, VG—General, *Metasequoia, Sequoia, Taxodium, Glyptostrobus, Cryptomeria, Pinus, Larix, Robinia.*

735. **Yoshino, Masatosi.** (Cf. No. 250). PH—*Morus.*

736. **Yoshitada, Kato.** (Cf. No. 210). IN—*Cryptomeria.*

737. **Yuichi, Saito.** (Cf. No. 215). PS, SO—*Pinus.*

738. **Zamotalov, S. S.** Moscow State University, Chair of Genetics and Selection, Moscow, Russia. EM, PO—*Ficus.*

739. **Zavadil, Zdenek.** (Cf. No. 231). FL, HS, PC, PH—*Juglans.*

740. **Zelawski, Wlodzimiersz.** Polska Akademia Nauk, Katedra Fizjologii Roślin SGGW, ul. Rakowiecka 8, Warszawa, Poland. GR, TR—*Larix.*

741. **Zinnai, Iwao.** (Cf. No. 250). MU, PL—*Pinus, Cryptomeria.*

742. **Zinno, Y.** (Cf. No. 210). HG—*Pinus.*

743. **Zohary, M.** Hebrew University of Jerusalem, Botany Department, Jerusalem (New City), Israel. HN, RA, TA—*Tamarix.*

744. **Zubarev, Vladislav M.** (Cf. No. 125). BM, SE—*Quercus.*

II—Alphabetical List of Subject Matter Symbols by Worker Numbers

Symbol	Subject
BA	Variation and inheritance of bark characters. (Cf. BW). 169, 319, 537, 575, 608, 625, 631, 705, 729.
BH	Variation and inheritance of branching habit, including size, angle, number, persistence of branches. 5, 17, 148, 154, 204, 318, 373, 381, 388, 454, 469, 573, 610, 673, 705, 713, 715.
BM	Breeding, general, and breeding methods. (Cf. SE, TG). 6, 11, 15, 27, 30, 32, 45, 55, 56, 62, 67, 72, 89, 97, 101, 110, 115, 117, 120, 124, 125, 126, 133, 135, 137, 140, 146, 148, 149, 151, 157, 159, 169, 175, 178, 179, 183, 186, 192, 195, 197, 198, 205, 211, 212, 227, 231, 234, 238, 255, 258, 271, 275, 278, 283, 286, 289, 302, 303, 307, 308, 311, 316, 323, 328, 331, 332, 334, 335, 338, 340, 346, 349, 351, 354, 357, 359, 360, 363, 372, 375, 376, 393, 396, 397, 401, 408, 418, 426, 432, 444, 450, 455, 456, 464, 471, 474, 475, 485, 486, 487, 488, 494, 495, 497, 499, 502, 503, 512, 513, 514, 517, 521, 527, 529, 535, 536, 538, 550, 560, 566, 569, 577, 583, 584, 590, 596, 598, 599, 603, 604, 605, 612, 614, 615, 617, 634, 645, 649, 651, 667, 686, 689, 693, 696, 698, 700, 713, 716, 720, 725, 730, 732, 744.
BW	Variation and inheritance of yield or properties of bark and wood extractives. (Cf. RE). 104, 139, 285, 343, 432, 471, 537, 539, 631, 710.
CF	Variation and inheritance of crown form characteristics. 290, 454, 572, 673, 715.
CO	Variation and inheritance of cone, seed, and fruit characteristics. 27, 46, 79, 101, 202, 218, 232, 267, 292, 347, 355, 395, 408, 440, 501, 542, 573, 575, 630, 642, 644, 681, 694.
CP	Cone or fruit insects and diseases, control of birds and animals in seed orchards or seed production areas. 150, 630.
CS	Control of pests, including fungi, insects, birds and animals in processed seed, or in seed and seedlings in the nursery or field plantings. 101, 586, 687.
CT	Clonal testing, tree shows. 13, 17, 172, 204, 205, 221, 235, 237, 265, 312, 351, 372, 376, 397, 408, 419, 428, 448, 496, 524, 593, 595, 609, 653, 673, 700.
CV	Clonal variation, general. 13, 32, 67, 68, 70, 94, 101, 171, 265, 316, 372, 376, 397, 445, 448, 477, 524, 554, 653, 664, 673, 713.
CY	Cytogenetics and cytology, chromosome number, chromosome staining, and chromosomal aspects of crossability. 1, 12, 35, 44, 63, 76, 84, 91, 145, 163, 178, 190, 196, 203, 207, 208, 211, 228, 234, 239, 240, 245, 270, 271, 278, 309, 310, 356, 370, 376, 378, 388, 397, 413, 422, 437, 447, 449, 460, 464, 478, 486, 516, 550, 551, 612, 615, 620, 624, 628, 632, 672, 676, 695, 726.
DR	Variation and inheritance of disease resistance, including physiology or mechanisms of resistance and physiologic races of pathogens. 7, 11, 23, 24, 30, 37, 38, 43, 47, 49, 56, 65, 67, 75, 85, 100, 106, 110, 111, 130, 136, 139, 146, 147, 151, 156, 159, 178, 185, 191, 195, 220, 227, 233, 238, 258, 260, 271, 273, 284, 286, 302, 335, 336, 339, 349, 351, 360, 374, 385, 396, 397, 401, 408, 414, 418, 432, 448, 451, 456, 461, 468, 471, 479, 484, 488, 489, 495, 503, 504, 508, 514, 524, 525, 528, 529, 543, 546, 552, 554, 557, 563, 568, 571, 572, 574, 583, 604, 605, 606, 609, 612, 637, 645, 653, 675, 680, 686, 700, 711, 713, 730.
EM	Embryology, including mechanisms of pollination and fertilization and cotyledony. (Cf. SP). 9, 18, 76, 122, 153, 208, 229, 230, 272, 314, 325, 347, 366, 370, 388, 512, 545, 549, 582, 585, 621, 628, 647, 738.
EV	Evolution, natural selection, family and population studies, including paleodendrological aspects. (Cf. HE). 27, 29, 131, 138, 205, 259, 267, 313, 422, 505, 555, 645.
EX	Experimental design, nursery and field sampling of wild or planted test materials. 13, 27, 128, 264, 351, 598, 646.
FE	Forest tree fertilization and nutrition, including mineral deficiencies. (Cf. IN, SA, SO). 32, 61, 113, 128, 144, 155, 158, 166, 210, 218, 246, 318, 360, 368, 407, 408, 412, 414, 429, 434, 443, 469, 481, 491, 492, 493, 562, 593, 607, 659, 699, 707, 712, 719, 722.
FL	Floral biology, especially in relation to control pollination or breeding procedures. 9, 13, 18, 31, 81, 84, 95, 112, 114, 122, 129, 133, 148, 158, 160, 184, 195, 196, 223, 272, 273, 283, 325, 328, 337, 342, 386, 408, 417, 424, 463, 467, 486, 493, 523, 537, 542, 560, 575, 581, 582, 592, 621, 653, 663, 671, 674, 685, 707, 721, 724, 728, 739.
FO	Variation and inheritance of foliage characters, including morphology, color, biochemistry, etc. 29, 46, 79, 85, 101, 242, 259, 267, 276, 288, 292, 293, 294, 298, 335, 347, 350, 351, 416, 420, 423, 432, 445, 447, 520, 521, 524, 534, 537, 559, 575, 577, 590, 591, 609, 625, 655, 675, 676, 681, 695, 713.
FR	Variation and inheritance of fruiting or fruitfulness and seed yield or set, including climatic influences. 13, 14, 17, 22, 78, 129, 154, 156, 158, 176, 202, 204, 206, 241, 273, 282, 341, 342, 382, 386, 387, 406, 408, 410, 417, 424, 428, 440, 459, 469, 476, 493, 512, 519, 523, 527, 563, 564, 582, 584, 589, 593, 609, 621, 630, 635, 653, 671, 688, 694, 704, 721, 732.
GG	General forest genetics, including educational and administrative aspects, libraries, translations, directories, bibliographies, herbaria, arboreta, etc. 6, 45, 61, 71, 89, 103, 112, 115, 119, 202, 220, 240, 258, 263, 304, 309, 346, 351, 372, 397, 408, 433, 490, 517, 547, 559, 563, 564, 566, 567, 573, 584, 598, 633, 651, 652, 653, 698, 701, 713.
GI	Genetical improvement of natural stands. 59, 90, 192, 289, 335, 351, 444, 486, 532, 633, 653, 701.
GR	Variation and inheritance of growth rate or increment, including growth efficiency. (Cf. PS). 17, 23, 62, 67, 68, 69, 73, 109, 134, 142, 148, 174, 180, 184, 185, 190, 196, 204, 220, 223, 237, 243, 258, 318, 322, 335, 432, 436, 459, 469, 476, 486, 503, 510, 514, 524, 537, 538, 561, 565, 568, 572, 589, 598, 609, 637, 645, 673, 676, 700, 702, 713, 740.
HA	Variation, inheritance, and testing of winter, frost, or cold hardiness. 21, 29, 52, 85, 111, 115, 124, 130, 168, 185, 198, 258, 259, 260, 268, 273, 282, 291, 308, 311, 326, 346, 353, 465, 469, 470, 480, 515, 537, 596, 604, 605, 612, 631, 667, 669, 670, 676, 678, 704, 713.
HE	Statistical genetics, including narrow or broad sense heritability, combining ability, parent-progeny correlations, dominance, epistacy, etc. 2, 27, 48, 105, 131, 151, 154, 178, 211, 318, 351, 408, 432, 537, 589, 598, 645, 646, 653, 673, 698, 713.
HG	Hybridization interspecific and intergeneric. 6, 7, 27, 29, 30, 42, 55, 62, 72, 77, 84, 85, 89, 94, 115, 117, 128, 132, 134, 148, 151, 156, 172, 173, 178, 185, 190, 192, 196, 197, 205, 220, 223, 227, 233, 235, 238, 243, 252, 253, 261, 270, 271, 276, 278, 281, 286, 289, 297, 302, 303, 311, 316, 326, 328, 336, 349, 351, 355, 360, 363, 389, 393, 396, 401, 408, 418, 419, 428, 432, 441, 456, 459, 467, 468, 469, 471, 472, 474, 477, 485, 486, 512, 513, 514, 529, 537, 540, 546, 550, 563, 569, 577, 578, 583, 590, 592, 598, 604, 612, 615, 617, 637, 653, 665, 669, 670, 686, 688, 691, 693, 711, 713, 720, 729, 730, 742.
HN	Hybridization, natural, including introgression and hybrid swarms. 7, 12, 21, 27, 40, 48, 79, 87, 93, 99, 108, 116, 170, 242, 259, 276, 309, 313, 347, 355, 365, 416, 442, 447, 501, 521, 530, 537, 540, 546, 581, 609, 657, 743.
HP	Hybrid performance, including hybrid interplantings. 6, 23, 41, 72, 101, 156, 199, 220, 243, 261, 271, 320, 328, 351, 355, 356, 408, 418, 432, 469, 510, 521, 529, 563, 571, 578, 595, 700, 713.
HR	Variation and inheritance of drought, heat, and salt resistance. 98, 120, 130, 148, 177, 295, 481, 576, 589, 676.
HS	Hybridization, intraspecific and intraracial. 4, 27, 85, 117, 148, 151, 156, 196, 220, 223, 328, 351, 393, 441, 458, 529, 560, 616, 713, 732, 739.
HY	Hybridization and hybridity, general, including crossability patterns, determination of hybridity, interspecific incompatibility, and heterosis or hybrid vigor. 27, 58, 308, 347, 370, 388, 439, 537, 612.
IE	Introduction (acclimatization) and performance of exotics or breeding materials of exotic origin. 7, 16, 17, 23, 47, 69, 72, 88, 123, 124, 170, 172, 177, 182, 192, 199, 200, 219, 220, 233, 239, 247, 254, 261, 269, 274, 287, 295, 305, 309, 315, 329, 333, 345, 346, 350, 351, 354, 364, 389, 394, 398, 404, 408, 435, 444, 452, 462, 465, 467, 470, 481, 486, 494, 507, 522, 526, 531, 533, 541, 546, 548, 552, 563, 570, 571, 580, 605, 627,

638, 640, 643, 644, 653, 654, 656, 667, 669, 670, 700, 702, 712.

IN Flower induction in reproductively immature trees, photoperiodic, chemical, mechanical, etc. 10, 13, 14, 17, 43, 156, 210, 220, 221, 225, 232, 249, 271, 296, 379, 382, 392, 407, 408, 421, 428, 429, 431, 443, 445, 482, 492, 493, 498, 556, 593, 609, 661, 692, 698, 707, 734, 736.

IR Variation and inheritance of insect or animal resistance. 7, 11, 80, 84, 96, 151, 156, 220, 221, 226, 233, 284, 402, 456, 509, 538, 552, 574, 583, 613, 637, 664, 666, 713, 732.

MU Mutation, mutation rates and induced mutation, including chimeras and sports. 1, 7, 54, 131, 184, 202, 222, 257, 270, 271, 351, 437, 470, 525, 527, 546, 586, 603, 660, 677, 741.

NT Nursery and transplanting technology. 7, 69, 103, 124, 144, 156, 168, 182, 210, 232, 254, 351, 364, 367, 368, 370, 394, 418, 441, 487, 546, 563, 615, 616, 644, 650, 687, 710, 713, 730.

NU Nut and coconut selection and breeding. 2, 23, 78, 110, 168, 212, 300, 375, 485, 569.

PA Parthenocarpy, apomixis, asyndesis. 9, 13, 202, 636.

PC Controlled pollination technique. (Cf. PE). 7, 13, 31, 51, 68, 110, 122, 129, 156, 160, 215, 221, 223, 224, 256, 261, 270, 271, 297, 328, 351, 355, 388, 389, 408, 428, 441, 467, 479, 486, 513, 519, 540, 546, 550, 560, 578, 581, 586, 615, 629, 653, 665, 667, 688, 700, 709, 713, 730, 739.

PD Pollen dissemination. (Cf. EV, SO). 13, 14, 43, 62, 127, 148, 154, 189, 241, 244, 351, 358, 360, 388, 396, 425, 508, 577, 584, 592, 599, 646.

PE Pollen handling, including collection, extraction, forcing, storage, purity, and germination. 31, 261, 270, 280, 286, 384, 388, 393, 395, 411, 418, 421, 453, 486, 496, 577, 587, 660, 662, 665, 688, 709, 723.

PH Phenology, general, or in relation to seed set, time of pollination and seed collection, cross- or self-ability, and insect, disease, or frost injury. 16, 20, 96, 107, 128, 158, 174, 185, 226, 231, 268, 273, 276, 277, 283, 292, 297, 299, 311, 332, 335, 355, 396, 408, 409, 425, 427, 428, 440, 448, 467, 469, 481, 486, 513, 570, 592, 600, 671, 724, 729, 735, 739.

PL Polyploidy, natural and induced. (Cf. CY, MU). 7, 62, 85, 132, 145, 208, 228, 238, 239, 243, 245, 252, 265, 271, 311, 312, 403, 437, 449, 458, 470, 514, 546, 581, 584, 615, 623, 653, 676, 713, 741.

PO Pollen and pollen grain studies, general, including pollen morphology, tube growth and metabolism, and paleobotanical aspects. 13, 46, 77, 83, 85, 121, 129, 138, 153, 173, 217, 224, 244, 256, 297, 325, 341, 348, 358, 369, 370, 384, 388, 430, 446, 447, 457, 463, 484, 505, 513, 541, 577, 581, 621, 635, 641, 658, 660, 684, 713, 727, 738.

PQ Variation and inheritance of pulping qualities, including cell length and strength, fibril angle, density, etc. 66, 68, 85, 105, 134, 222, 233, 270, 306, 317, 322, 419, 466, 604, 612.

PR Provenance (provenience) studies. 5, 17, 20, 23, 25, 27, 31, 57, 59, 62, 64, 73, 74, 80, 92, 103, 115, 118, 128, 131, 142, 143, 151, 152, 159, 161, 166, 172, 181, 196, 220, 223, 233, 248, 261, 266, 271, 274, 285, 311, 315, 322, 335, 350, 351, 354, 363, 372, 373, 377, 383, 385, 389, 401, 410, 418, 433, 438, 440, 450, 481, 486, 490, 511, 530, 539, 543, 563, 565, 566, 567, 568, 572, 573, 578, 579, 592, 598, 601, 602, 604, 608, 611, 612, 637, 648, 653, 667, 668, 682, 690, 698, 700, 702, 713, 718, 722, 730, 733.

PS Basic physiologic studies in growth or growth efficiency, metabolism, water relations, auxin relations, apical dominance, topophysis, etc. (Cf. GR, TR). 61, 109, 110, 112, 143, 148, 158, 159, 188, 205, 214, 237, 258, 261, 353, 368, 371, 374, 382, 385, 392, 397, 461, 479, 491, 515, 521, 524, 556, 558, 579, 581, 589, 593, 618, 621, 622, 652, 675, 678, 692, 703, 707, 713, 719, 737.

RA Distribution or range studies concerning varieties, species, or other taxa. 12, 153, 209, 247, 273, 292, 293, 380, 400, 415, 521, 555, 568, 597, 695, 743.

RE Variation and inheritance of resin, latex, gum or sap yield and quality. 27, 61, 146, 213, 303, 390, 433, 496, 506, 512, 536, 713, 716.

RO Variation and inheritance of rooting habit, including wind firmness or other root characters. 198, 227, 558, 572, 653, 730.

SA Seed production areas in improved natural stands. (Cf. FE, FR, SO). 78, 80, 150, 154, 166, 262, 387, 388, 404, 438, 469, 553, 599, 610, 653, 718.

SC Seed collection, extraction, storage, viability and soundness tests, seed crop periodicity and forecasting. (Cf. SG). 5, 9, 22, 74, 78, 150, 205, 276, 289, 311, 324, 344, 351, 361, 367, 396, 408, 410, 417, 418, 440, 456, 563, 584, 596, 599, 630, 644, 650.

SE Selection, general, including methods and techniques, selection indices, juvenile-mature tree growth, or other relations affecting efficacy of selection. 55, 115, 125, 126, 133, 137, 140, 149, 179, 186, 192, 197, 255, 275, 278, 289, 308, 323, 331, 338, 340, 343, 350, 357, 375, 401, 405, 408, 432, 450, 459, 462, 464, 474, 475, 479, 485, 494, 495, 499, 502, 533, 536, 550, 563, 565, 566, 569, 583, 593, 596, 617, 619, 626, 632, 649, 656, 683, 693, 696, 720, 744.

SF Variation and inheritance of bole or stem form, forking, crook, sweep, straightness, etc. 68, 70, 134, 148, 151, 154, 172, 220, 335, 388, 436, 468, 503, 565, 572, 637.

SG Seed physiology studies, including pre-germination treatment, germination seed testing procedures, and embryo culture. (Cf. EM, SC, SP). 9, 31, 34, 43, 46, 50, 62, 74, 79, 93, 101, 109, 133, 144, 156, 164, 184, 201, 202, 206, 214, 217, 232, 250, 256, 260, 270, 295, 298, 324, 325, 327, 336, 360, 363, 375, 378, 382, 393, 396, 406, 417, 418, 421, 440, 463, 483, 487, 493, 500, 512, 518, 533, 544, 545, 558, 560, 563, 564, 578, 584, 589, 605, 611, 630, 636, 661, 671, 676, 683, 687, 688, 690, 706, 707, 710.

SI Self-incompatibility and -compatibility, self-infertility and -fertility, selective fertilization, inbreeding depression, albinism, etc. (Cf. HY, PO). 101, 160, 164, 196, 221, 233, 271, 286, 341, 350, 351, 388, 393, 471, 486, 513, 519, 615, 635, 645.

SL Seed, stock, tree, and clone registration, laws, regulations, and certification, including planting zones and plus and elite tree or stand registration. 3, 5, 17, 22, 62, 73, 123, 141, 172, 219, 232, 271, 289, 344, 350, 351, 361, 408, 417, 428, 438, 486, 508, 514, 563, 568, 630, 645, 650, 698, 700.

SO Seed orchard technology in planted orchards, including spacing, shaping, pollen contamination, etc. (Cf. FE, FR, SA, SI). 13, 14, 17, 28, 43, 62, 80, 85, 102, 144, 154, 159, 172, 186, 192, 194, 205, 211, 216, 218, 220, 221, 230, 236, 237, 261, 262, 265, 271, 286, 289, 303, 311, 312, 318, 327, 351, 352, 354, 359, 361, 367, 372, 376, 379, 381, 388, 397, 408, 463, 469, 486, 508, 581, 594, 595, 599, 604, 609, 630, 644, 645, 653, 667, 668, 679, 682, 693, 694, 698, 713, 718, 737.

SP Seed physiology studies, metabolic and other basic studies. (Cf. SG). 34, 336, 544, 611.

SS Selection, stands. 172, 194, 262, 289, 350, 361, 438, 508, 553, 637, 638, 653.

ST Selection, single trees and mass selection. 5, 13, 17, 19, 32, 39, 45, 49, 56, 62, 67, 68, 72, 84, 85, 97, 129, 134, 144, 148, 151, 154, 157, 162, 167, 176, 184, 194, 196, 202, 204, 205, 211, 212, 223, 233, 235, 236, 238, 243, 251, 256, 257, 258, 262, 270, 271, 283, 284, 295, 300, 311, 312, 316, 321, 332, 335, 350, 354, 355, 361, 363, 372, 376, 381, 386, 388, 389, 390, 391, 393, 397, 408, 428, 433, 436, 438, 441, 444, 450, 459, 477, 486, 503, 512, 514, 521, 546, 566, 577, 586, 589, 599, 612, 616, 637, 638, 648, 653, 667, 676, 679, 698, 700, 709, 710, 713, 717, 725, 731, 732.

SW Seed weight in relation to seedling size. (Cf. CO). 34, 190, 335, 360, 410, 540, 600, 630, 645.

TA Taxonomy, including cytotaxonomy, varietal testing and identification, and botanical nomenclature. 7, 27, 33, 40, 48, 58, 79, 88, 93, 153, 170, 173, 196, 199, 209, 229, 242, 247, 267, 268, 276, 288, 292, 293, 294, 304, 313, 339, 347, 372, 380, 396, 399, 400, 415, 416, 420, 437, 439, 445, 448, 534, 537, 546, 547, 555, 559, 577, 580, 591, 643, 676, 695, 713, 743.

TE Progeny testing, including theoretical considerations, one- and two-parent tests, polycrossing and dialled crossing, etc. 2, 5, 13, 29, 68, 129, 148, 151, 154, 196, 233, 261, 271, 318, 351, 354, 373, 375, 393, 408, 428, 459, 469, 486, 496, 512, 598, 637, 645, 646, 667, 673, 676, 700, 713.

TG Genetics of varieties, species, or other taxa. (Cf. BM, SE). 7, 19, 27, 29, 30, 45, 56, 67, 68, 84, 86, 133, 135, 146, 165, 193, 234, 267, 271, 277, 278, 281, 311, 316, 326, 330, 351, 360, 363, 370, 396, 397, 401, 432, 459,

463, 485, 521, 537, 538, 550, 566, 569, 577, 583, 605, 617, 645, 691, 696, 697, 698, 717, 720.

TR Tropisms, including photoperiodism, thermoperiodism, etc., and basic studies. (Cf. IN, PS). 10, 32, 50, 55, 61, 178, 188, 194, 250, 256, 295, 320, 328, 350, 360, 362, 371, 476, 483, 558, 560, 561, 579, 598, 604, 609, 618, 621, 661, 687, 698, 707, 708, 714, 730, 740.

VA Variation, general, basic studies in clinal or ecotypic variation, including edaphic, climatic, geographic, etc., variation. 8, 12, 17, 20, 21, 27, 29, 36, 58, 60, 62, 63, 66, 69, 72, 79, 90, 98, 104, 119, 120, 148, 151, 161, 166, 173, 180, 186, 233, 240, 259, 261, 269, 283, 290, 294, 295, 311, 324, 335, 339, 350, 360, 363, 372, 380, 396, 397, 399, 400, 423, 438, 441, 445, 463, 487, 501, 508, 512, 520, 522, 534, 559, 561, 563, 565, 568, 572, 573, 578, 596, 597, 601, 608, 609, 610, 622, 625, 630, 639, 642, 645, 653, 655, 663, 669, 670, 676, 677, 680, 693, 695, 698, 705, 713, 715.

VC Vegetative propagation by cuttings, layers, leaf bundles, or leaves. 13, 17, 26, 53, 65, 67, 71, 91, 101, 102, 109, 124, 143, 148, 151, 155, 159, 162, 174, 187, 196, 198, 201, 220, 221, 235, 238, 251, 261, 265, 269, 287, 295, 298, 301, 311, 318, 328, 335, 351, 354, 391, 393, 408, 421, 428, 441, 445, 450, 460, 461, 478, 487, 514, 537, 562, 563, 581, 588, 589, 598, 600, 609, 625, 627, 629, 644, 648, 651, 660, 667, 673, 682, 689, 697, 706, 707, 710, 713, 731, 732.

VG Vegetative propagation by grafting or budding. 28, 62, 85, 101, 113, 117, 148, 151, 156, 167, 171, 172, 195, 197, 201, 202, 204, 205, 211, 215, 225, 230, 233, 237, 261, 265, 289, 311, 312, 316, 318, 334, 335, 351, 355, 367, 376, 381, 389, 408, 428, 433, 456, 469, 478, 496, 503, 518, 529, 550, 562, 593, 600, 612, 619, 627, 630, 637, 644, 667, 679, 682, 694, 700, 703, 713, 731, 734.

VP Vegetative propagation, general, including basic studies on origin of roots, stock-scion relations, etc. 25, 26, 120, 167, 171, 223, 263, 298, 301, 382, 390, 392, 408, 456, 460, 527, 529, 533, 558, 596, 653, 703.

WA Variation and inheritance of tolerance to high soil moisture, flooding, etc. 32.

WG Variation and inheritance of wood grain characteristics, including spiral grain, figured grain, and veneer or other special grains. 82, 97, 219, 223, 271, 279, 306, 322, 372, 398, 473, 508, 577, 600, 713.

WQ Variation and inheritance of wood qualities, including strength and other properties, wood anatomy. 68, 105, 134, 148, 214, 227, 261, 317, 319, 322, 466, 473, 514, 537, 608, 625.

III—Alphabetical List of Countries, with Workers

Albania

Qosja, X.

Argentina

Alberti, F. R.
Alonzo, A. E.
Barderi, C. H.
Barrett, W. H. G.
Brückmann, J. J.
Contardi, H. G.
Golfari, L.
Hunziker, J. H.
Leonardis, R. F. J.
Mangieri, H.
Pahlen, E. K. de Von
Ragonese, A. E.
Tesdorff, H.

Australia

Ashton, D. H.
Barber, H. N.
Binet, F. F.
Boden, R. W.
Brown, A. G.
Clifford, H. T.
Costa, E. W. B. da
Dadswell, H. E.
Eldridge, K. G.
Fielding, J. M.
Florence, R. G.
Harding, J. H.
Hopkins, E. R.
Jackson, W. D.
Kloot, N. H.
McWilliams, J. R.
Moulds, F. R.
Nicholls, J. W. P.
Nikles, D. G.
Pawsey, C. K.
Perry, D. H.
Plumridge, A. J.
Pryor, L. D.
Rudman, P. R.

Austria

Grüll, H.
Günzl, L.
Harm, H.
Holzer, K.
Larcher, W.
Pisek, A.
Rannert, H.
Schreiber, M.
Tranquillini, W.
Trauninger, W.
Vieghofer, L.
Wettstein-Westersheim, W.
Wieser, R. F.

Belgium

Boudru, M.
DeMortier, G.
Fouarge, J.
Galoux, A.
Gathy, P. E.
Jamblinne deMeux, A. de
Miegroet, P. van
Muhle Larsen, C.
Reginster, P.

Belgian Congo

Bourdeau, P. F.

Bermuda

Jones, J. H.

Brazil

G.-Penteado de Castro, Y.
Guimaraes, R. F.
Gurgel-Filho, O. do A.
Mattos, H. P. S. de

British West Indies

Moone, D.

Bulgaria

Dobrinov, I.
Gantchev, P.
Stefanov, B.

Canada

Allen, G. S.
Bannan, M. W.
Bier, J. E.
Black, M.
Carmichael, A. J.
Chiasson, L. P.
Chouinard, L.
Contrashoff, S. F.
Cram, W. H.
Dance, B. W.
Dansereau, P.
Ebell, L.F.
Farrar, J. L.
Finnis, J. M.
Fowler, D. P.
Fraser, D. A.
Garman, E. H.
Grace, H. N.
Heimburger, C. C.
Holst, M. J.
Hunter, A. W. S.
Hutchinson, A. H.
Johnson, L. P. V.
Kennedy, R. W.
Legault, A.
Lepage, E.
Linzon, S. N.
MacGillivray, H. G.
Minshall, W. H.
Molnar, A. C.
Moore, R. J.
Moss, E. H.
Northcott, P.L.
Orr-Ewing, A. L.
Place, I. C. M.
Pomerleau, R.
Porter, W. A.
Radforth, N. W.
Schmidt, R. L.
Senn, H. A.
Siminovitch, D.
Swan, H. S. D.
Vaartaja, O.
Withers, G. B.
Yeatman, C. W.

Ceylon

Abeywardena, V.
Fernando, D. M.
Liyanage, D. V.
Rosayro, R. A. de
Wijeygunawardena, L.

Chile

Iturria, H. C.

China

Chang, C. T.
Chien, J. J.
Keng, H. (Taiwan)
Lin, W. (Taiwan)
Wang, T.(Taiwan)
Wu, H.

Czechoslovakia

Chmelar, J.
Cvančara, B.
Cvrkal, H.
Dušek, V.
Gonda, P.
Hofman, J.
Kanak, K.
Kantor, J.
Kovalovsky, D.
Laffers, A.
Lehotsky, L.
Pospíšil, J.
Richtar, B.
Sindelár, J.
Václav, E.
Vajčik, V.
Vincent, G.
Vojtus, M.
Zavadil, Z.

Denmark

Barner, H.
Møller, C. Mar:
Blinkenberg, C.
Brandt, K.
Bryndum, H.
Gøhrn, V.
Keiding, H.
Kindt, S.
Knudsen, M. Y.
Løfting, E.
Lundberg, J.
Naess-Schmidt, K.
Nielsen, P.C.
Petersen, B. B.
Schaffalitzky de Muckadell, M.
Søegaard, B.F.
Syrach Larsen, C.
Treschow, C.

East Africa

Griffith, A. L.

England

(See Great Britain)

Ethiopia

Rader-Roitzsch, J. E.

Finland

Donner, J.
Hagman, M.
Heikinheimo, O.
Kärki, L.
Kujala, V.
Leinonen, P.
Leskinen, U.
Oskarsson, O.
Pitkänen, K.
Saarnijoki, K.
Sarvas, R.
Tigerstedt, A.
Tigerstedt, P.
Viro, P. J.

France

Bouvarel, P. F.
Camefort, H.
Campo-Duplan, M. van
Codaccioni, M.
David, R.
Dilleman, G.
Favre-Ducharte, M.
Ferré, Y. de
Garavel, L.
Gaussen, H. M.
Grandgirard, A.
Guinaudeau, J.
Lemoine, M.
Leredde, C.
Regnier, R.
Rol, R.
Turpin, P.

Germany (East)

Achterberg, H. H.
Boland, G.
Curschmann, O. H.
Dittmar, O.
Eifler, I.
Erteld, W.
Göhre, K.
Günther, H.
Guttenberg, H. von
Hoffmann, K.
Jahnel, H.
Jentsch, J.
Joachim, H.-F.
Kootz, F. W.
Krumbiegel-Richter, B.
Lyr, H.
Ortmann, C.
Polster, H.
Regler, W.
Scamoni, A.
Scholz, E.
Schönbach, H.
Schröck, O.
Schubert, J. A. O.
Templin, E.
Teucher, G.
Thümmler, K.
Wachter, H.
Wagenknecht, E.

Germany (West)

Alleweldt, G.
Barner, J. M.
Bartels, H.
Bauer, F.
Bauer, R.
Behrndt, G.
Boerner, F.
Bolsinger, E.
Braun, H. J.
Buchholz, E.
Butin, H.
Conrad, J.
Curschmann, O. H.
Dellingshausen, M. von
Dieckert, H.
Dimpflmeier, R.
Eichbaum, K. L. J.
Eisenhut, G.
Ernst, W.
Flöhr, W.
Fröhlich, H.-J.
Gerhard, H.
Gothe, H. L.
Grehn, J.
Hassenkamp, W.
Hausser, K.
Heitmüller, H. H.
Herrmann, S.
Hesmer, H.
Huber, B.
Illies, Z.-M.
Kanitz, H. R.
Karl, J.
Karnatz, H.
Klauditz, W.
Kleinschmit, R.
Knapp, W.
Krahl-Urban, J.
Langner, W.
Lantelmé, W.
Lichte, H. F.
Lücke, H.
Marquardt, H.
Mayer-Krapoll, H.
Messer, H.
Meyer, H.
Meyer-Uhlenried, K.-H.
Mitscherlich, G.
Moritz, O.
Müller, R.
Neugebauer, W.
Priehäusser, G.
Punin, W.
Rack, K.
Rohmeder, E.
Rohmeder, M.
Röhrig, E.
Rossmässler, W.
Rubner, K.
Sauer, E.
Schell, G.
Schlenker, G.
Schmidt, H.
Schmidt, W.
Schmitt, R.
Schmucker, T.
Schneider, B.
Schober, R.
Schönborn, A. von
Schönhar, S.
Schönnamsgruber, H.
Schrötter, F. W. von
Schütt, P.
Schütte, F. S.
Seitz, F. W.
Stern, K.
Wittich, W.

Great Britain (England)

Brazier, J.D.
Buszewicz, G.
Carlisle, A.
Champion, H. G.
Christie, J. M.
Day, W. R.
Gardiner, A. S.
Garner, R. J.
Gregory, P. H.
Harland, S. C.
Holmes, G. D.
Jeffers, J. N. R.
Jobling, J.
Jones, E. W.
Leyton, L.
Luckwill, L. C.
Maggs, D. H.
Matthews, J. D.
Melville, R.
Mitchell, A. F.
Murray, J. S.
Ovington, J. D.
Peace, T. R.
Pearsall, W. H.
Richens, R. H.
Topps, J. H.
Vyvyan, M. C.
Wood, R. F.
Worsley, R. G. F.

Great Britain (Ireland)

Doyle, J.

Great Britain (Scotland)

Edwards, M. V.
Faulkner, R.
Laing, E. V.
Lines, R.
McNeill, W. M.
Pollock, W. P.
Richardson, S. D.

Great Britain (Wales)

Hyde, H. A.
Longman, K. A.
Wareing, P. F.

Greece

Georgopoulos, A.
Papaionnou, J. C.

Hungary

Bano, I.
Domokos, J.
Kárpáti, I.
Kárpáti, V.
Kárpáti, Z.
Kerényi, E.
Kopecky, F.
Mátyás, V.
Nádasi, M.
Porpáczy, A.
Proboeskai, E.
Sebök, L.
Sipos, E.
Szonyi, L.
Tompa, K.

India

Ammal, E. K. J.
Bakshi, B. K.
Davis, T. A.
Gupta, M.
Johri, B. M.
Kadambi, K.
Kedharnath, S.
Khoshoo, T. N.
Konar, R. N.
Kuppuswami, B. S.
Lakhandal, R. N.
Mathur, R. N.
Mehra, P. N.
Mittre, V.
Mukherjee, S. K.
Nair, P. K. K.
Puri, G. S.
Raizada, M. B.
Rao, C. V.
Rao, H. S.
Sahni, K. C.
Sarkar, P.
Sastri, R. L. N.
Sharma, A. K.

Indonesia

Josowidjojo, L. D.
Wood, G. H. S.

Iran

Mirdamadi, E.

Ireland

(See Great Britain)

Israel

Gindel, J.
Kaplan, J.
Karshon, R.
Zohary, M.

Italy

Allegri, E.
Arru, L. Z.
Bagnaresi, U.
Battaglia, E.
Biraghi, A.
Cappelli, M.
Giordano, E.
Magini, E.
Morandini, R.
Philippis, A. de
Piccarolo, G.
Ruggeri, C.
Sarfatti, G.
Sekawin, M.
Spada, A.

Japan

Asada, S.
Chiba, S.
Fukuda, M.
Funabiki, K.
Goo, M.
Hamaya, T.
Harada, H.
Hasegawa, M.
Hashizume, H.
Hatano, K.
Hirayoshi, I.
Ikuse, M.
Inokuma, T.
Ishii, S.
Ishikawa, H.
Ishikawa, S.
Ishizaki, A.
Ito, I.
Ito, T.
Iwakawa, M.
Iwamura, M.
Kariyone, T.
Kato, Y.
Kawagoe, H.
Kawana, A.
Kimura, A.
Kimura, C.
Kunimura, N.
Kurata, T.
Maeda, C.
Matsui, Z.
Matsumoto, Y.
Matsuura, T.
Matsuzaki, S.
Migita, K.
Miki, S.
Miyake, I.
Murai, S.
Muto, K.
Nakahira, K.
Nakamura, K.
Narita, Y.
Negisi, K.
Nishimura, S.
Nohara, Y.
Ogasawara, K.
Okada, Y.
Okanoue, M.
Okudai, S.
Ono, K.
Onozawa, Y.
Ozaki, K.
Ozawa, J.
Saito, Y.
Sato, K.
Sato, Y.
Satoo, S.
Satoo, T.
Sawada, T.
Shibata, K.
Shidei, T.
Shigemoto, M.
Shimamura, T.
Shioda, I.
Simura, T.
Sobajima, Y.
Sugihara, Y.
Sugimura, Y.
Takahara, S.
Takahashi, N.
Takenouchi, M.
Takeuchi, M.
Tanaka, K.
Tashima, Y.
Toda, R.
Toyama, S.
Ueno, J.
Watanabe, M.
Watanabe, S.
Yamasaki, N.
Yamazaki, T.
Yanagihara, T.
Yanagisawa, T.
Yokoyama, M.
Yokozawa, Y.
Yoshikawa, K.
Yoshino, M.
Yoshitada, K.
Yuichi, S.
Zinnai, I.
Zinno, Y.

Korea

Ahn, K. Y.
Hong, S. C.
Hyun, S. K.
Kang, K. W.
Kim, C. S.
Lee, T. B.
Shim, S. Y.
Yim, K. B.

Malaya

Paardekooper, E. C.

Mexico

Martinez, M.
Mejorada, N. S.
Puente, J. M. de la

Morocco

Franclet, A.

Mozambique (Portuguese East Africa)

Guerreiro, M.

Netherlands

Boer, S. de
Boom, B. K.
Broekhuizen, J. T. M.
Ende, G. van den
Gerritsen, C. J.
Gremmen, J.
Hellinga, G.
Heybroek, H. M.
Jansen, E. C.
Meiden, H. A. van der
Oudemans, T. C.
Reinders-Gouwentak, C. A.
Soest, J. van
Veen, J. H. van der
Vloten, H. van
Vries, P. G. de
Wassink, E. C.
Went, J. C.
Wiersma, J. H.
Wolterson, J. F.

New Zealand

Bannister, M. H.
Beuzenberg, E. J.
Hair, J. B.
Kennedy, D.
Larsen, E.
Morrison, F. T.
Poole, A. L.
Rattenbury, J. A.
Rawlings, G. B.
Thulin, I. J.
Weston, G. C.

Norway

Aass, I.
Austin, T.
Børset, O.
Dietrichson, J. F.
Langhammer, A.
Løken, A.
Mork, E.
Robak, H.
Ruden, T.
Saetersdal, L. S.
Strand, L. K.

Pakistan (East and West)

Khan, A. U.
Khan, M. I. -ur-R.

Peru

Rocha-Garcia, G. de la

Poland

Bellon, S.
Bialobok, S.
Bialobrzeska, M.
Bugala, W.
Chmielewski, W.
Chodzicki, E.
Hejnowicz, Z.
Janson, L.
Jentys-Szaferowa, J.
Kociecki, S.
Milkowska, A.
Mroczkiewicz, L.
Myczkowski, S.
Podgorska, J.
Pohl, Z.
Staszkiewicz, J.
Suszka, B.
Truchanowiczówna, J.
Tyszkiewicz, S.
Wilusz, Z.
Zelawski, W.

Portugal

Machado, D. Pereira
Paixão-Correia, C. A. de
Vaz, A. L. C.

Portuguese East Africa

(See Mozambique)

Romania

Beldie, A.
Benea, V.
Clonaru, A.
Dumitriu-Tataranu, I.
Lăzărescu, C.
Oeskay, S.
Petrescu, L.
Purcelean, S.

Russia

Albensky, A. V.
Anisimova, A. I.
Bogdanov, P. L.
Chichladse, L. S.
Danilov, M. D.
Dylis, N. V.
Dzhiaukshtas, P. I.
Enkova, E. I.
Ermakov, V. I.
Filimonova, V. D.
Frolova, G. D.
Globa-Mikaienko, D. A.
Grigor'ev, G. V.
Ivannikov, S. P.
Jablokov, A. S.
Junovidov, A. P.
Kairov, I. A.
Kalinina, I. V.
Kalmykov, S. S.
Kazartsev, I. A.
Kazaryan, V. O.
Knyazev, V. P.
Konovalov, N. A.
Kormilintsin, A. M.
Koslenko, G. M.
Kotelova, N. B.
Kotyukov, A. E.
Kudasheva, R. F.
Kundzinesh, A.
Kuznetsova, V. I.
Legachev, I. N.
Leman, V. M.
Matskevich, N. B.
Maurin, A. M.
Minina, E. G.
Misnik, E. G.
Mushegjan, A. M.
Nekrasov, V. I.
Nekrasova, T. P.
Noskov, V. I.
Nyesterov, V. G.
Orlenko, E. G.
Ozol, A. M.
Ozolin, G. A.
Panin, V. A.
Pavlenko, F. A.
Piatnitsky, S. S.
Polozova, L. Y.
Pravdin, L. F.
Prokazin, E. P.
Rovsky, V. M.
Rubanik, V. G.
Rusanov, F. N.
Severova, A. I.
Shchepotev, F. L.
Shcherbena, K. G.
Shershukova, O. P.
Sokolov, N. O.
Sokolov, S. Y.
Sukachev, V. N.
Tatarintsev, A. S.
Tcherniavski, P.
Vechov, N. K.
Veresin, M. M.
Yablokov, A. S.
Lyubavskaya, A. Y.
Manzhos, A. M.
Zamotalov, S. S.
Zubarev, V. M.

Scotland

(See Great Britain)

South Africa (Union of)

Jurriaanse, A.
Kirkman, P. A.
Kotzé, J. J.
Loock, E. E. M.
Marsh, E. K.
Moffett, A. A.
Nel, P. M.
Nixon, K. M.
Nôrskov-Lauritsen, G.
Poynton, R. J.

Spain

Artaza, J. E.
Elorrieta, J.
Gallastequi, C.
Martin Bolaños, M.
Martinez-Mata, F.
Molina-Rodriguez, F.
Prats-Zapirain, M.
Tjio, J. H.
Urquijo-Landaluze, P.
Vicitez, E.

Sudan (Africa)

Poulsen, G.

Sweden

Akebrand, V.
Andersson, E.
Andersson, S.
Arnborg, T.
Bang, G. F.
Bergman, F.
Ehrenberg, C. E.
Eiche, V. J.
Johnsson, H.
Kiellander, C. L.
Langlet, O.
Liljefors, A.
Lindquist, B.
Ljunger, A.
Lundén, R.
Muntzing, A.
Nilsson, B.
Oksbjerg, E. B.
Persson, A.
Petrini, S.
Plym-Forshell, C.
Rennerfelt, E.
Simak, M.
Soderberg, E.
Stefansson, E.M.
Tamm, C. O.
Tirén, L.
Tralau, H. W.

Erdtman, G.
Erdtman, H.
Florin, R.
Gadd, I.
Gustaffson, A
Hadders, G.
Hagner, S. O. A.
Håkansson, A.
Hellström, N. A.
Hjelmqvist, H.
Hylander, N.
Ingestad, T.
Jensen, S.

Switzerland

Bazzigher, G.
Bovet, J.
Burger, H.
Cornuz, L.
Fischer, F.
Kurth, A.
Leibundgut, H.
Marcet, E.
Mühlethaler, K.
Surber, E.

Turkey

Cepel, N.
Kayacik, H.
Saatcioglu, F.
Semizoglu, M. A.

Uruguay

Rubbo, R.

Yugoslavia

Anic, M.
Fukarek, P.
Jovanovic, B.
Knezevic, I.
Krstic, M.
Panov, A.
Pejoski, B.
Urban, S.
Vicentic, M. A.
Vidakovic, M.

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The Use of Slowly Soluble Fertilizers in Forest Planting in the Pacific Northwest

R. C. Austin and R. F. Strand

SLOW GROWTH of planted seedlings is a serious problem in forest management because it lengthens the rotation, and because slow growing seedlings are vulnerable for longer periods of time to drought, to wildlife damage, and to overtopping and matting by competing vegetation. Experience in reforestation during the past 15 years on Crown Zellerbach Corporation's Tree Farms in the Pacific Northwest indicates that on many areas repeated plantation failures might have been avoided if seedlings had grown more rapidly. Therefore, the Corporation's applied forest research program has included an investigation of the use of fertilizers to improve early growth rate of planted conifers.

Review of Previous Work

Trials of fertilizer applications on planted seedlings from 1951 to 1956 are summarized in Table 1. Many of the results of this earlier work were negative or inconclusive. However, in 1955 several trials at Tahkenitch Tree Farm on the southern Oregon coast using 2 ounces of Golden Vigoro (Swift & Company) spread about the soil surface near the stems of established Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) and Monterey pine (*Pinus radiata*) seedlings indicated that good growth responses were possible (Table 1). The results of these trials coupled with the reports of favorable results in the world literature (*14*) were inducement to further effort to develop a practical means of fertilizing planted seedlings. Experience indicated that the following difficulties had to be overcome:

1. The large amounts of fertilizers needed for area applications.

2. The favorable influence of fertilization on competing vegetation.

3. The measurement of proper amounts of fertilizer under field conditions.

4. The handling of powdered or granulated fertilizers under field conditions.

5. The transporting of bulky fertilizers (low concentration) in the field.

6. The loss of nutrients by lateral movement on the soil surface.

7. The "burning" of seedlings due to close placement of readily soluble fertilizers.

8. The possible rapid loss of readily soluble fertilizer elements (especially N) by leaching through the soil profile.

Others have reported using the technique of applying fertilizer in the planting hole (*1*) (*3*) (*7*) (*9*) (*11*) (*13*) (*15*). This method eliminates surface losses, and minimizes the potential advantage to competing vegetation. Compressing the fertilizer into pellets of desired size would measure the proper amount, and simplify the handling of the fertilizer (Fig. 1). It was hoped that other difficulties could be overcome by using a highly concentrated, slowly soluble source of fertilizer material. For the most part the fertilizers used in the earlier studies were from either a highly concentrated readily soluble inorganic source or a less concentrated slowly soluble organic source, both of which were less than ideal for this purpose. In Japan (*11*) solid fertilizers were synthesized from chemical fertilizers (type not specified but presumably readily soluble inorganic salts) and peat using applications of heat and pressure to promote reactions between these ingredients to reduce solubility. A mixture of urea, calcium monohydrogen phosphate, and ORZAN (spray dried sulfite spent liquor) was pelleted in 12 gm. tablets and used in 1956 field planting trials in Douglas-fir at Cathlamet Tree Farm in southwest Washington. The mortality in the fertilized seedlings was eight times that experienced with control seedlings (Table 1). Calcium monohydrogen phosphate or superphosphate used singly in these trials did not appreciably increase mortality which indicated that urea was too soluble as a nitrogen source and its solubility was not reduced sufficiently in the ORZAN tablet. A less soluble but highly concentrated source of nitrogen was desired, therefore, in future trials.

By the summer of 1956 frequent discussions of urea-formaldehyde resin as a fertilizer containing a high percentage of slowly soluble nitrogen were noted in agronomy publications and a literature review was initiated to determine its utility as a pellet fertilizer. Urea-formaldehyde resins can have a variety of physical and chemical properties, depending upon the ratio of urea to formaldehyde in

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FIG. 1.—The various sizes and shapes of fertilizer pellets in these jars show the different stages of development of the fertilizer pellet evolving from the flat wafer-like, 12 gm. pellets used in the 1956 field trials at Cathlamet, through the long cylindrical 15 gm. pellets used in 1957 field trials, to the short cylindrical 7-9.3 gm. pellets used in the 1958 field trails.

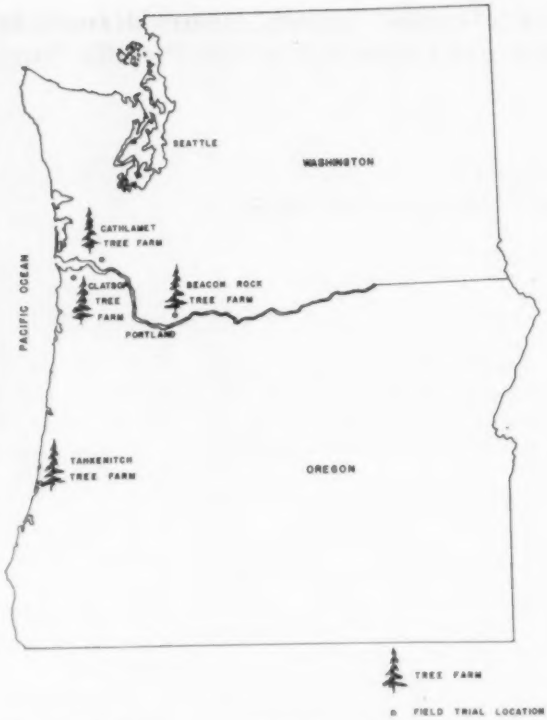

FIG. 2.—The general location of Crown Zellerbach Corporation Tree Farms and pellet fertilizer field trial areas included in this study.

the reaction blend, upon the pH or catalyzing agent, and upon the curing and heat treatment during and after the initial reaction (*4*) (*5*). The fertilizer type resins are made with mole ratios of 1 to 1.5 or more (urea to formaldehyde), are partially soluble, will decompose slowly in soil, and have a relatively high nitrogen content (38 percent). Field trials indicated that urea-formaldehyde fertilizers were effective for many field crops, especially long season crops such as turf (*2*) (*8*). Commercial sources such as DuPont's Uramite and Borden's 38 are available on the market.

Methods

Development.—During the fall of 1956 a number of urea-formaldehyde fertilizer resins were produced experimentally in an attempt to investigate a broader nitrogen solubility range than commercial fertilizer resins could provide. Heat treatment, method of preparation, and initial U/F mole ratio were varied to give resins with different solubility characteristics. In one method of preparation phosphoric acid was used both to catalyze the reaction and serve as a source of P_2O_5 in the final fertilizer form. A total of six pellet treatments was selected for field trials using three experimental types—two resin types used both with and without phosphorus—a commercial resin, Uramite, with superphosphate, and a control. A description of these treatments is given in Table 2.

A pellet weight of 15 grams was judged to be approximately the largest size that could be economically handled for a single tree in planting operations. Since the primary purpose of this trial was to compare the effectiveness of urea-form types, equal amounts (11.25 gms.) of the resin were used in each case. The remaining 3.75 grams was a phosphorus source fertilizer.

The 3-1 ratio of nitrogen to phosphorus source used was partly arbitrary, but partly based on the relative leaching of the two in soil, some physiological aspects of nutrient absorption and uptake, and a knowledge of the regional soils. Experience in forest fertilization in the Douglas-fir region of the Pacific Northwest indicates that nitrogen and phosphorus are the two elements most likely to produce responses; however, phosphorus has not produced definite responses in field fertilization trials with forest trees (*6*). Nitrogen and phosphorus absorption in plants is strongly interelated and an excess of one will depress the uptake of the other (*10*). Therefore, presence in the pellet of both elements is desirable. Mineralized nitrogen can be rapidly leached away as it is formed while movement of phosphates in soil is extremely limited. Thus, less phorphorus is necessary to provide a balance of nitrogen and phosphorus available in the rooting zone of a seedling over a period of several growing seasons.

Field trials at Cathlamet.—A bracken fern (*Pteridium aquilinum pubescens*) covered lower slope near Cathlamet, Wash., where the

urea pellet had been previously tested was selected as a trial site (Fig. 2). This south slope had been burned frequently by Indians and early settlers until the late 1930's. The dense stand of bracken fern which developed, with the aid of deer and rabbit damage, wiped out a plantation of 1-0 Douglas-fir planted in 1946. In the same area 2-0 Sitka spruce (*Picea sitchensis*) plantations planted in 1946 were successful. The soil, a Hembre silt loam, is deeply weathered from igneous rock, well drained, and moderately permeable.

In March, 1957, 768 Douglas-fir 2-0 seedlings from Greeley Forest Nursery at Nisqually, Wash., were planted in a 3 x 3 foot spacing. The area was divided into two sections with a 25-foot buffer strip between. On half the area bracken fern was clipped several times during the growing season to simulate chemical or mechanical control. A rabbit exclosure fence was placed around half the trial area including both the cleared and uncleared bracken fern cover. The six pellet treatments were randomized within each of the eight blocks contained in each site treatment (bracken fern removal and control). Each pellet treatment segment contained 8 trees.

The trial was examined in September, 1957, to determine average total height, height growth, survival, and vigor. In September, 1958, the examination of this trial included also measurement of basal stem diameter.

In the spring of 1958 another field trial was installed within the rabbit exclosure at Cathlamet testing the effect of different amounts of fertilizer pellets of three types B, D and G (Table 2) as compared to the control (unfertilized) on 2-0 Douglas-fir from Greeley Forest Nursery. Treatments were individually randomized and staked within each of the three blocks contained in each site treatment.

Field trials at Beacon Rock Tree Farm.—A bracken fern-covered ridge top near Washougal in southwest Washington was selected for a trial of pellet fertilizer (18.6 gms. type D) on Douglas-fir and noble fir (*Abies procera*) during 1958. The plot area was part of the 1903 Yacolt burn and has subsequently been reburned many times. The soil, an Olympic silt loam, is deeply rooted, well drained with moderate permeability and is stony throughout the solum.

The trial consisted of four blocks divided into two different site treatments (bracken fern removal). Within each of these subblocks species and fertilizer treatment were randomized. An evaluation of height growth, vigor, and survival was made in 1958.

Field trials at Olney Burn.—At Clatsop Tree Farm near Astoria, Ore., a fertilizer pellet trial was installed in January, 1958, to supplement a recent test of site preparation by scarification. The area was logged during the 1920's and burned several times during the 1930's. Several plantations have failed in the past 15 years and the area is sparsely stocked with conifers exclusive of 1958 regeneration efforts. The vegetation cover is of two main types: (1) bracken fern-willow (*Salix* spp.) and (2) salmonberry (*Rubus spectabilis*)-sword fern (*Polystichum munitum*). The soil, an Astoria silt loam, appears to have a shallower phase which supports the salmonberry-sword fern cover while the deeper phase in general supports the bracken fern-willow cover. The trial included three species of seedlings—Douglas-fir, Sitka spruce, and grand fir (*Abies grandis*). These species and pellet fertilizer treatments (14 gms. type B pellets) were randomized ithin 48-tree blocks. Four blocks were placed in each of two

TABLE 1.—SUMMARY OF FERTILIZER APPLICATION TRIALS ON FOREST TREE SEEDLINGS

Location	Date of establish.	Planting stock	Treatment description	Results
Clackamas Tree Farm near Mollala, Ore.	Urea spray June 1951 Others April 1952	1948 Noble fir Douglas-fir plantation—Poor growth area	¾ acre plot 44#/A N-Urea spray One acre plots 50#/A N-ORZAN (spray dried sulphite spent liquor) 150#/A N-NH_4SO_4 400#/A K_2O-K_2SO_4	Visual examination no difference between control-fertilized.
E. P. Stamm Tree Farm near Mist, Ore.	Feb.-April 1952	Douglas-fir 1-0 1820 Fertilized 243 Control	Plowed, subsoiled, fertilized disced 100#/A N-NH_4SO_4 200#/K_2O-K_2SO_4 500#/A $CaOH_2$-Ground limestone	1st year survival, fertilized 40 percent, control 79 percent. Growth better on fertilized. 2nd year fertilized plantation destroyed by a build up of the *Microtus* (field mice) population.
Tahkenitch Tree Farm near Florence, Ore.	May 1955	Monterey pine 1953, 1954 and 1955 planting Sitka spruce & Douglas-fir 1955 plantings. 50 trees/trial	4 ounces of a 1:1 mixture of Golden Vigoro and ground phosphate rock spread over 4 $ft.^2$ area around the seedling 60#/A N 300#/A P_2O_5 40#/A K_2O	Substantial responses 1955 and 1956 on all plantings but 1953 pine. 1954 less than 1955 pine. Evidence of fertilizer washing away.
Cathlamet Tree Farm near Cathlamet, Wash.	Phosphate Feb. 1956 Urea April 1956	Douglas-fir 2-0 PO_4—360 trees Urea—288 trees	In the planting hole pellet containing Urea $(NH_2)_2CO$ 5 gm. $CaHPO_4$ 5 gm. ORZAN 2 gm. Paper capsule 5 gms. super phosphate or $CaHPO_4$	Urea caused eight times the mortality in fertilized than the control. No difference in survival for PO_4 treated and control.

TABLE 2.—DESCRIPTION OF DIFFERENT PELLET FERTILIZER TREATMENTS USED IN FIELD PLANTING TRIALS

Code letter	Treatment	Initial mole ratio U/F	Nitrogen % N	Phosphorus % P_2O_5
A	No treatment	—	—	—
B	Urea-formaldehyde plus phosphoric acid. Concentrated preparation. Regular heat treatment (130° C.—48 hours)	1.5	28.4	20.0
			35.0	0.5
C	Urea-formaldehyde plus phosphoric acid. Concentrated preparation. Low heat treatment (105° C.—48 hours)	1.5	28.4	20.0
D	Uramite plus superphosphate	—	27.1	5.5
			28.5	3.1
E	Urea-formaldehyde, plus superphosphate. Dilute preparation. Regular heat treatment (130° C.—48 hours)	1.5	28.9	5.5
F	Urea-formaldehyde, no added superphosphate. Dilute preparation. Regular heat treatment (130° C.—48 hours)	1.5	38.5	0
G[1]	Urea-formaldehyde plus 1/10 phosphoric acid. Concentrated preparation. Regular heat treatment (130° C.—48 hours)	1.5	38.2	2.0

[1]Used only in the 1958 trial at Cathlamet Tree Farm.
[2]Results of analysis made on fertilizer pellets after one year in the soil at Cathlamet Tree Farm.

TABLE 3.—MULTIPLE RANGE AND "F" TESTS[1] FOR STEM DIAMETER AND HEIGHT GROWTH WITH SURVIVAL AND VIGOR[2] FOR DOUGLAS-FIR SEEDLINGS OF DIFFERENT PELLET TREATMENTS IN THE 1957 PLANTATION FIELD TRIAL AT CATHLAMET TREE FARM

1958 Stem diameter—Cm.
Pellet type

Control	A	F	E	C	B	D
	0.71	0.77	0.78	0.80	0.82	0.84

1957 Height growth—Inch
Pellet type

Control	A	E	F	B	D	C
	2.89	3.57	3.70	4.01	4.12	4.16

1958 Height growth[4]—Inch
Pellet type

Control	A	F	E	B	C	D
	11.18	13.02	13.14	13.24	13.87	15.84

1957 Survival—percent
Pellet type

B	C	F	E	Control A	D
81.0	84.4	94.6	95.3	96.2	96.8

1958 Survival—percent
Pellet type

B	C	F	D	E	Control A
76.6	82.8	92.3	94.6	95.3	96.2

1957 Healthy Seedlings[5]—Percent

Control	A	B	C	F	E	D
	30.5	32.0	40.7	42.2	46.1	47.8

1. Duncan, D. B. Multiple range and multiple "F" tests. Biometrics 11, pp. 1-9. 1955.
2. Survival and vigor data were not statistically analyzed.
3. Any two means *not underscored* by the same line are significantly different at the 0.05 level.
   Any two means *underscored* by the same line *are not* significantly different at the 0.05 level.
4. The growth was measured from trees only in the cleared portion of the trial due to extensive rabbit damage on the uncleared area outside the exclosure.
5. Healthy seedlings were classified as above average in vigor as determined by size, needle length and color, form, etc.

cover types (bracken fern-willow and salmonberry-sword fern). Eight additional plots were placed outside the scarified area, four in each cover type for a total of 16 blocks.

Field trials at Tahkenitch Tree Farm.—Tahkenitch Tree Farm, located on the southern Oregon coast, has been the site of seedling fertilizer trials since 1955. The trials have been principally in recent cutover lands and in some cases these areas were slash burned. Growing conditions are excellent with an exceptionally long growing season in this area. Brush undergrowth consisting of native rhododendrons (*Rhododendron macrophyllum*), salmonberry, vine maple (*Acer circinatum*), salal (*Gaultheria shallon*), etc. occur in dense thickets in many situations such as old cutovers, burns, or open grown old-growth Sitka spruce or Douglas-fir stands. The soils are sandy and well drained in the area. The individual trials were laid out by species in three rows with three treatments randomized throughout.

In the spring of 1956 a comparison of phosphorus sources, five gram, paper wrapped, capsules of monohydrogen phosphate and superphosphate was made in field trials with three species of planted seedlings—Douglas-fir, Monterey pine and grand fir. The capsules were placed in the planting hole at the time of planting. Several trials with type B and type D (see Table 2) were installed in the spring of 1957 using Monterey × knobcone hybrid pine (*Pinus attenuata* × *radiata*) and Sitka spruce seedlings. Similar trials were installed during 1958.

Results and Discussion

Field trials at Cathlamet Tree Farm.—The effect of the different pellet treatments on height growth, stem diameter, survival, and vigor of Douglas-fir seedlings (Fig. 3) in the Cathlamet trial for 1957 and 1958 is shown in Table 3. The results are arranged by pellet treatment in numerical order increasing in quantity from left to right. Mul-

tiple range and multiple "F" tests have been made on those measurable characteristics which were found to be significantly affected by pellet treatment (Table 4) in an analysis of variance of the trial data. A table of variance is not shown in this article, but a 1957 height growth analysis was also made which indicated that pellet treatment was very highly significant. The multiple range and multiple "F" test from this analysis are shown in Table 3. Stem basal diameter in 1958 was one such characteristic which was found to be significant yet no individual pellet treatment could be distinguished in the multiple range test in Table 3. Three pellet types B, C, and D were significantly different from the control A in the 1957 height growth analysis. Only C and D were significant in the 1958 height growth analysis. The 1958 height growth was taken from measurements in the cleared portion of the trial because the uncleared area outside the exclosure suffered extensive rabbit damage during August of 1958.

TABLE 4.—TABLE OF VARIANCE OF STEM DIAMETER AND 1959 HEIGHT GROWTH OF SEEDLINGS, CATHLAMET TREE FARM—1957 TRIAL

Source of variation	Type of analysis: Stem diameter Df	Stem diameter M.S.	Ht. growth Df	Ht. growth M.S.	Ht. growth (Cleared only) Df	Ht. growth (Cleared only) M.S.
Site treatment	1	5.714	1	0.715		
Blocks in Site treatment	14	0.015	6	0.057		
Pellet treatment	5	0.032*	5	0.059	5	0.124**
Pellet treatment × site treatment	5	0.023	5	0.053		
Blocks					7	0.076
Error	70	0.011	30	0.027	35	0.025

* Significant at the 0.05 level.
** Significant at the 0.01 level.

Note: Dr. Lyle D. Calvin, statistician, of the Oregon State Agricultural Experiment Station gave valuable guidance to the authors on the methods of statistical analysis used in this study.

Statistical analyses were not made on the number of healthy seedlings or survival in this study at Cathlamet. The percentage of healthy seedlings in 1957 by pellet treatment ranged from 30.5 percent for the control to 47.8 percent for the type D pellet (Table 3). Survival in 1957 was seriously affected by the two pellet types B and C, which averaged about 82 percent compared to about 95 percent for other pellet types and the control. Very little additional mortality was evident in the 1958 examination. The H_3PO_4 contained in type B and C apparently caused

FIG. 3.—A fertilized (*left*) and a control Douglas-fir seedling (*right*) pictured from the 1957 Cathlamet field trial illustrate the difference in their size and development after two growing seasons. The white coating is a ZAC-Rhoplex mixture which was sprayed on each seedling for protection from wildlife damage.

the additional mortality experienced in this trial. An analysis of types B and D pellets after one year in the soil (Table 2) reveals the probable cause of this mortality. The P_2O_5 was practically all gone from the phosphoric acid resin B while less than half was missing from the superphosphate contained in the D resin. Solubility checks on the E and F resins indicated that nitrogen in these types was less soluble than B, C, and D which would explain the differences in growth response noted.

Type D pellet (Uramite and superphosphate) proved to be the best pellet fertilizer. It provided good growth responses without a reduction in survival from that of the control. Types B and C gave a similar growth response the first year though they were far short of D in the second year (Table 3). Two pellet types B and D were selected for further trials on the basis of first year results. Growth and survival results for these two and the control are summarized in Table 5 by site treatment or site preparation for all the field trials reported. The averages for 1957 at Cathlamet indicates very little effect of fern clearing the first season. The second season a decided effect is evident showing a reduction in the response to the fertilizer pellets both in height growth and stem diameter under the bracken fern cover. Also, during the second growing season, control seedlings grew less in height and stem diameter under the fern cover as compared to control seedlings in the fern removal area. Figure 4 illustrates this relationship in graphic form for the control and pellet type D, the commercial resin (Uramite, with superphosphate).

Apparently competition for nutrients is not the most limiting growth factor in the undisturbed bracken cover. Soil moisture samples taken at 6, 12, and 24 inches in depth during the 1958 growing season did not indicate any drastic differences between cleared and uncleared bracken fern cover though the five samples were inadequate in number to conclude that there was not a significant difference. Shading of the seedlings by the bracken fern would appear to be the most important element of competition involved. If this relationship holds true over broad areas of coastal brush types, and there is no particular reason to suppose that it does not, then this suggests that pellet fertilizers would have to be used in combination with site preparation measures in order to be effective in areas of heavy brush cover. However, it should protect the investment made in site preparation by promoting the rapid rate of seedling growth and development necessary to effectively utilize the temporary advantage such site preparation measures offer.

The measurements of the 1958 trial at Cathlamet did not reveal any consistent pattern of response to different amounts of pellet fertilizer ranging from 5 to 18.6 grams for the several pellet types used. Therefore, the growth and survival results were averaged by pellet types regardless of amount and reported in Table 5. Type D again gave the best survival and height growth though the average of 3.06 inches growth is well below the 1957 trial average of 4.12. The increase in mortality caused by B pellets in the 1957 trial did not materialize in the 1958 trial, probably because the smaller pellets used were less likely to become lodged part way down the planting hole and forced into direct contact with seedling roots when the hole was tamped closed.

Field trial at Beacon Rock Tree Farm.—Pellet treatment (2-9.3 gm. type D pellets) was not particularly effective in increasing height growth or survival for Douglas-fir and noble fir at Beacon Rock (Table 5). Bracken fern clearing depressed height growth of both species and increased survival especially for noble fir (38 percent to 78 percent) whereas it had completely the opposite effect on Douglas-fir at Cathlamet. This fundamental difference in influence of the cover type on establishing conifer seedlings tends to support the validity of the observed difference in first year seedling growth responses. Climatic differences between the two areas are contributed to by elevation, physiography, and distance from the ocean.

Field trial at Clatsop Tree Farm.—Height growth of Sitka spruce seedlings was significantly

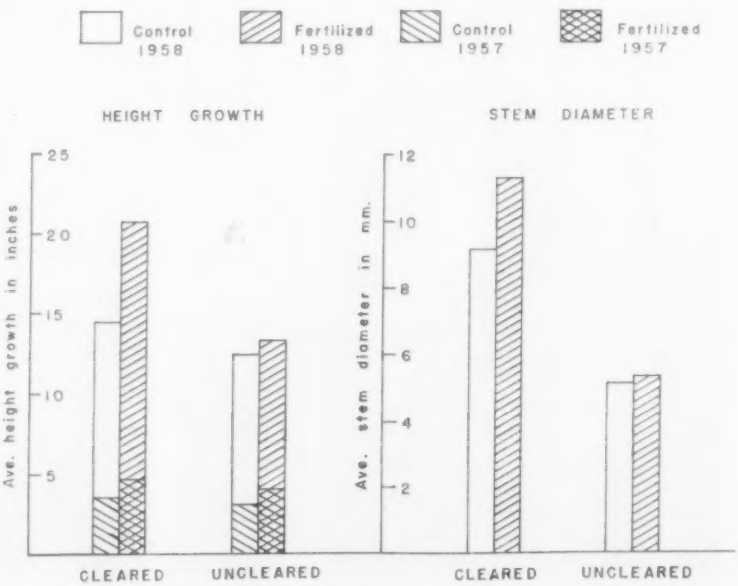

FIG. 4.—A graphic representation of the effect of fertilization (type D pellet) on 1957 and 1958 height growth and 1958 stem diameter of Douglas-fir seedlings in the cleared and uncleared portions of the 1957 Cathlamet Tree Farm field trial.

TABLE 5.—SUMMARY OF RESULTS OF FIELD TRIALS ON VARIOUS CROWN ZELLERBACH TREE FARMS SHOWING THE EFFECT OF PELLET FERTILIZERS ON THE GROWTH AND SURVIVAL OF SEVERAL SPECIES OF PLANTED SEEDLINGS

	Control				B Pellet Fertilizer			D Pellet Fertilizer		
	Total height	Height growth	Stem diameter	Percent survival	Height growth	Stem diameter	Percent survival	Height growth	Stem diameter	Percent survival
	Inch	*Inch*	*Cm.*		*Inch*	*Cm.*		*Inch*	*Cm.*	
Cathlamet Tree Farm										
1957 Trial—Douglas Fir										
1957 Results										
Cleared	9.46	3.00	.....	95	4.16*	.....	72	4.73*	.....	98
Uncleared	8.93	2.78	.....	100	3.86*	.....	86	3.52	.....	95
1958 Results										
Cleared	19.57	11.18	0.92	95	13.20	1.09*	70	15.84*	1.14*	98
Uncleared	17.42	9.48	0.51	97	9.85	0.56	83	9.48	0.53	91
1958 Trial—Douglas Fir										
1958 Results										
Cleared	10.46	2.23	.....	80	2.60	.....	90	2.94	.....	94
Uncleared	10.97	2.94	.....	100	2.96	.....	91	3.17	.....	92
Beacon Rock Tree Farm										
1958 Trial—Douglas Fir										
Cleared	10.78	1.80	.....	71	.....	.....	.....	2.14	.....	81
Uncleared	12.05	2.54	.....	62	.....	.....	.....	2.66	.....	62
1958 Trial—Noble fir										
Cleared	6.05	1.33	.....	78	.....	.....	.....	1.31	.....	69
Uncleared	5.92	1.49	.....	38	.....	.....	.....	1.60	.....	25
Clatsop Tree Farm										
1958 Trial—Dougas Fir										
Scarified	12.09	2.68	.....	94	2.92	.....	91	.....	.....	.....
Unscarified	10.31	2.20	.....	94	2.90	.....	89	.....	.....	.....
1958 Trial—Sitka spruce										
Scarified	5.81	2.64	.....	98	3.70*	.....	97	.....	.....	.....
Unscarified	6.33	2.58	.....	97	2.88*	.....	91	.....	.....	.....
1958 Trial—Grand fir										
Scarified	8.45	2.47	.....	100	2.82	.....	96	.....	.....	.....
Unscarified	8.51	2.83	.....	98	2.38	.....	92	.....	.....	.....
Tahkenitch Tree Farm										
1957 Trial—Monterey × knobcone hybrid pine										
1957 Results	10.23	3.73	.....	97	6.02**	.....	97	5.72*	.....	100
1958 Results	31.30	21.67	1.61	97	25.21	2.22**	97	23.50	1.98*	100
1957 Trial—Sitka spruce										
1957 Results	9.72	4.05	.....	100	5.03	.....	100	4.88	.....	100
1958 Results	16.21	6.46	.....	93	10.41**	.....	97	9.33**	.....	90

	Control			Superphosphate			$CaHPO_4$		
Phosphorus Sources	Total height *Inch*	Height growth *Inch*	Percent survival	Total height *Inch*	Height growth *Inch*	Percent survival	Total height *Inch*	Height growth *Inch*	Percent survival
1956 Trials									
1956 Results—Monterey pine	4.60	3.83	78		5.37***	72	.....	3.88	66
1958 Results—Monterey pine	31.45	.....	71	40.04**	.....	66	37.79*	.....	64
1956 Results—Grand fir	5.60	1.60	99		0.91***	88	.....	1.12***	95
1958 Results—Grand fir	12.31	.....	90	14.70**	.....	87	14.60***	.....	94

*Statistically significant at the 0.05 level.
**Statistically significant at the 0.01 level.
***Statistically significant at the 0.001 level.

increased, about 25 percent, by pellet fertilizers (Table 5). The 20 percent increase in height growth of Douglas-fir on both scarified and unscarified sites was just short of being significant at the 0.05 level. Grand fir did not appear to respond in height growth to pellet fertilization. Over-all survival was significantly reduced by the use of the pellet fertilizer (2-7 gm. type B pellets), which supplies further evidence as to the undesirable side effects of this pellet type. Scarification increased height growth and survival to some extent for all species with or without fertilizer applications.

Field trials at Tahkenitch Tree Farm.—The first year results of the 1956 phosphorus source trials were so unimpressive that remeasurements were not made in 1957 (Table 5). Height growth of grand fir was significantly depressed for both phosphorus sources while superphosphate caused a significant 40 percent increase in height growth for Monterey pine. In 1958, however, total height measurements revealed an astonishing reversal for grand fir of about 20 percent increase in total height for both phosphorus sources which was statistically very highly significant. Monterey pine continued to show a 40 percent response for superphosphate and also a 20 percent response for $CaHPO_4$, which had showed no indication of being beneficial during the 1956 growing season. Survival was not seriously affected by the phosphate fertilizer capsules placed in the planting holes of either species.

The height growth response of Monterey pine and grand fir in the third year at Tahkenitch Tree Farm

is the only clear-cut evidence in this series of studies to indicate that phosphate fertilizers have a beneficial effect on planted conifer seedlings. It is doubtful that this result would be duplicated at other tree farms because the sandy soil at Tahkenitch is hardly typical of finer textured soils found throughout most of western Oregon and southwest Washington. It is interesting to note the similarity in growth rate and growth response to superphosphate of Monterey pine on sandy soils in New Zealand and Australia (*12*). Unfortunately, periods of frost are predicted by the Weather Bureau once every 50 years in this area of sufficient intensity and duration to kill Monterey pine. The hybrid pine (*attenuata* × *radiata*) reported in these field fertilizer trials represents efforts by George Harrington, C. Z.'s resident forester, and Dr. F. I. Righter, forest geneticist, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif., to produce and field test a frost resistant hybrid with *radiata's* growth rate (Fig. 5).

A comparison of B and D pellet types for Sitka spruce and the Monterey × knobcone hybrid pine (Table 5) indicated a slight but not significant advantage for the B type. Both pellet types significantly increased height growth the first year on the pine and the second year in Sitka spruce. Second year stem basal diameters on the hybrid pine, however, did show a significant increase of about 40-60 percent above the control. Survival was uniformly high (90-100 percent in 1957) and apparently was not affected by pellet treatment.

The differences noted at Cathlamet in height growth and survival of Douglas-fir between type B and type D pellets were not evident with the hybrid pine and Sitka spruce at Tahkenitch. This again suggests that the sandy nature of the soil is an important component to consider at Tahkenitch in analyzing field fertilizer trials. An inherent difference in height growth response of species is also suggested by the data in Table 5 for the hybrid pine (*attenuata* × *radiata*) and the Sitka spruce. The first year significant increase in hybrid pine height growth response as compared to nonsignificant difference for Sitka spruce has been duplicated in a 1958 field trial at Tahkenitch not reported here.

Results of 1959 examination.— An examination was made of all trials in the fall of 1959. The results of seedling measurements though not tabulated here in detail indicate that fertilizer response trends evident at Cathlamet and Tahkenitch Tree Farms apparently continued but to a somewhat lesser degree for the seedlings completing their third growing season. Seedlings of all species at Beacon Rock and Clatsop Tree Farm trials responded to fertilization in the cleared or scarified portion of the trials in the second growing season of these 1958 trials. This includes the true firs (noble and grand) which did not show a response during the 1958 growing season (Table 5).

Summary

Slow initial growth rate of planted seedlings may lengthen the effective rotation and increase the possibility of plantation failures. Efforts by Crown Zellerbach Corporation's forest research group to stimulate early growth of planted conifers with fertilizers did not meet with any appreciable success until tablets or pellets of fertilizer material were placed directly in the planting hole. The fertilizer materials used in this manner had to be bland to avoid root injury, slowly soluble to give sustained benefits, and have a high concentration of nutrient elements to be feasible to transport and handle.

After several false starts, urea-formaldehyde resin was selected as a highly concentrated slowly soluble source of nitrogen. Both superphosphate and phosphoric acid were used in combination with urea-formaldehyde for the original test series (U.F. N-11.25 gms. and P source 3.75 gms.).

Field trials at Cathlamet, Wash., indicate after two growing seasons that the type D pellet, a commercial resin, Dupont's Uramite, in combination with superphosphate, significantly increased height growth and basal stem diameter (42 percent and 24 percent respectively) of Douglas-fir when used in combination with a site treatment (bracken fern removal by clipping several times during the growing season). No response to fertilizers was evident under the undisturbed fern cover the second year which suggests that pellet fertilizers would have to be used in combination with site preparation

FIG. 5.—The Monterey X knobcone hybird pine plantation shown here in February 1960, after the third growing season is part of the 1957 trial of planting hole fertilizers at Lake Tahkenitch Tree Farm.

measures in order to be effective in areas of heavy brush cover.

The remaining tailormade resins were less effective than the commercial resin, Uramite with superphosphate. Fertilizer pellets with phosphoric acid as a phosphorus source caused several times the amount of seedling mortality as compared to the control or to the other pellet types. A field trial installed in 1958 was designed to provide information relating to the amount of fertilizer material necessary for growth and vigor advantages. Unfortunately, the first year results are not consistent enough to draw conclusions in regard to this phase of the problem.

At Beacon Rock Tree Farm near Washougal, Wash., very limited responses were evident with fertilizer pellets for Douglas-fir and practically no responses for noble fir. Removal of bracken fern increased survival and decreased height growth which is opposite to the effect of fern removal at Cathlamet Tree Farm. The failure of the pellet fertilizer to improve growth rate at Beacon Rock Tree Farm as compared to Cathlamet Tree Farm may be due to differences in climatic growth factors reflected by this fundamental difference in the reaction of the seedling to the removal of the brush cover.

Sitka spruce and Douglas-fir seedlings responded in height growth (26 percent and 20 percent respectively) after the first growing season to an application of pellet fertilizer at a scarification trial area on Clatsop Tree Farm near Astoria, Ore. Height growth of planted grand fir seedlings was not affected by the fertilizer treatment.

Grand fir at Tahkenitch Tree Farm on the south central Oregon coast treated with a 5 gm. capsule of superphosphate or calcium monohydrogen phosphate had a 20 percent increase in *total* height over the control seedlings despite a significant reduction in height growth caused by this treatment after the first growing season. True firs may be initially sensitive to fertilizer applications. The total height of Monterey pine was also increased over three growing seasons by applications of phosporus especially superphosphate (40 percent). This is the one instance in the series of field trials where phosphorus has proved to be a definite advantage. The sandy soil at Tahkenitch in contrast to the finer textured soils on other trial areas may account for the effectiveness of phosphorus fertilization as well as the lack of growth and mortality differences between resins.

Hybrid pine (*attenuata* × *radiata*) showed a significant height growth increase the first growing season while Sitka spruce responded significantly in the second growing season.

Results of a 1959 examination which are not presented in detail indicate that trends of seedling fertilizer response have continued to a lesser degree through the third growing season on trials at Cathlamet and Tahkenitch Tree Farms. Second growing season results from Beacon Rock and Clatsop Tree Farms show increased responses for all species (especially grand and noble fir) in the cleared or scarified portion of the trial areas.

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Early Growth of Radically Thinned Loblolly Pine

Robert Zahner and
F. W. Whitmore

A SHORT sawlog rotation for loblolly pine (*Pinus taeda* L.) may be possible in the South through a management system which produces relatively few large trees per acre while maintaining the greatest diameter growth on each. At the usual "wide" spacings (8 by 8 feet, for example), planted loblolly pine grows rapidly for the first few years, but then competition quickly and drastically slows it down. Radically wide initial spacing of perhaps 20 by 20 feet, along with later thinning, might promote rapid growth for a much longer period, provided that serious grass or brush competition could be avoided. Artificial pruning would be necessary to keep wood quality high.

During 1954, a study was started in south Arkansas to determine if loblolly of good quality can be grown rapidly by giving choice trees full room. The early development of stems, crowns, and roots of such trees has been closely measured and compared to trees grown under more conventional thinning practices. This paper reports the first five years of observation, but is not intended to recommend management procedures.

Study Area and Stand Treatment

The plantation selected for study had been established on abandoned farm land in the winter of 1945-1946. Original spacing of the 1-0 loblolly nursery stock was about 6 by 6 feet. Survival had been excellent, and in 1954 the stand contained more than 1,100 trees per acre. At 9 years of age, the dominant trees averaged 22 feet tall and 4 inches in diameter. Total basal area was about 70 square feet per acre. There was very little understory vegetation.

The plantation is on a gently rolling upland loess terrace with a 3 percent slope. The soil is a uniform Lexington series, with a grey silt loam surface grading into a yellow loam subsoil at about 12 inches. Internal drainage is imperfect, but surface drainage is good. The site index for loblolly pine on similar sites in the area is about 90 feet at age 50.

Three thinning treatments were replicated on quarter-acre plots in three blocks throughout the plantation. Two levels of radical thinning are being compared with a control thinning. In all treatments, 100 dominant trees per acre (25 per plot) were selected for the final crop. Spacing of these trees averages about 21 feet apart.

All three treatments favored the selected crop trees in the following manner:

1. *Sawlogs-only treatment.*—All trees other than the 100 crop trees per acre were cut before the 1954 growing season. Trees felled were too small for pulpwood, and had to be left on the ground. Future thinnings will reduce the stand to about half the number of crop trees by the end of the rotation period.

2. *Sawlogs-pulpwood treatment.*—All trees whose crowns were within 5 feet of the crowns of crop trees were cut before the 1954 growing season; the result was to leave little groups of closely spaced stems among crop trees. This procedure is repeated at 3-year intervals, thus providing some pulpwood harvest until only the 100 crop trees per acre remain—at which time the plots will be treated like the sawlogs-only plots.

3. *Control treatment.*—A conventional pulpwood thinning from below, favoring crop trees, was employed as the control. The first thinning was at age 12, when the stems were large enough for pulpwood, and subsequent thinnings are planned at 3-year intervals. Each thinning is to cut the stand back to 85 square feet of basal area.

Crop trees in the first two treatments are pruned at 3-year intervals to maintain about 50 percent of total tree height in live crown. No pruning is included in the control treatment.

Figure 1 shows typical plots of the three treatments during the second growing season (1955) after the study was established.

When the plantation was thinned, vegetative ground cover was sparse. There were a few small stems of persimmon (*Diospyros virginiana* L.), sumac (*Rhus* spp.), and sweetgum (*Liquidambar styraciflua* L.), but practically no herbs or vines. In the first few years after the heavy thinnings, vegetation typical of old-field succession invaded the open area around the crop trees. Crabgrass (*Digitaria* spp.) and horseweed (*Erigeron canadensis* L.) were abundant at first, but by the third year broomsedge (*Andropogon virginicus* L.) and dogfennel (*Eupatorium* spp.) dominated.

THE AUTHORS: When this article was prepared, both were members of the Southern Forest Expt. Sta., Forest Service, U. S. Dept. Agric. Dr. Zahner is now on the faculty of the Department of Forestry, School of Natural Resources, University of Michigan, Ann Arbor.

FIG. 1.—Views of the three treatments: *A*, Sawlogs-only; *B*, Sawlogs-pulpwood; *C*, Control. Photographs taken in 1955, the second growing season after thinning in sawlogs-only and sawlogs-pulpwood plots.

Except for some persimmon and sumac root sprouting, hardwood invasion has been negligible during the first five years.

Measurements and Growth

Stems.—As all crop trees were selected from the most vigorous individuals, their diameters are somewhat larger than the average tree in the sawlogs-pulpwood and control plots. Shown below is crop-tree diameter growth for the 5-year period:

Treatment	D.b.h. 1954	D.b.h. 1959	Periodic d.b.h. growth	Mean-annual growth
	Inches			
Sawlogs-only	4.2	8.5	4.3	0.86
Sawlogs-pulpwood	4.1	7.5	3.4	.68
Control	4.1	6.0	1.9	.38

Over the 5 years, diameter growth in the sawlogs-only plots was 2.3 times that of crop trees in the control plots. Sawlogs-pulpwood plots, intermediate in density, have made a diameter increase of 1.8 times that of the controls.

In 1953-1954 the average height of all crop trees was about 22 feet. After 5 years there are no significant differences in height growth among treatments. Trees on all plots grew 2.5 feet per year, and average 36 feet in height.

Four trees per plot were selected at random and fitted with aluminum growth bands just below breast height. Growth began each year in early March for all treatments. Control trees usually ceased growth by midsummer, whereas those in the other treatments grew well until fall. Sawlogs-only growth extended into November most years. The fastest growth rates for all treatments occurred during April each year. In the thinned plots another period of rapid growth was recorded in the fall. It is clear from Figure 2 that the thinned trees gained most of their growth advantage over the controls during the middle and late season, from June through October.

Basal area.—Changes in basal area and number of trees per acre are summarized in Table 1. On the sawlogs-only plots, where the original basal area of 71 square feet per acre was reduced to 10 square feet, growth averaged 6 square feet per acre per year (Fig. 3).

The less severe thinning in the sawlogs-pulpwood treatment reduced the stand in 1954 from 70 to 31 square feet per acre. (This initial thinning in the 9-year-old stand was not commercial.) The 1957 cut yielded 5 cords of pulpwood per acre, and reduced basal area to 29 square feet. Five-year basal-area growth averaged 10 square feet per acre per year.

Crowns.—In the spring of 1954, green crowns on the crop trees averaged 8 feet in diameter and comprised 55 percent of total tree height. Crown diameters of sawlogs-only and sawlogs-pulpwood crop trees increased to 16 and 14 feet, respectively, before the trees were repruned in 1957. Crown-height ratios built up to about 65 percent between 1954 and 1957, at which time they were reduced to 50 percent. Figure 4 compares the crowns of crop trees on control and sawlogs-only plots in 1957 be-

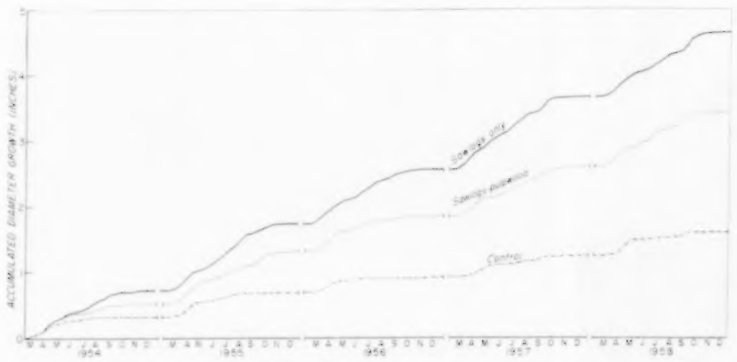

FIG. 2.—Diameter growth of crop trees, 1954-1958.

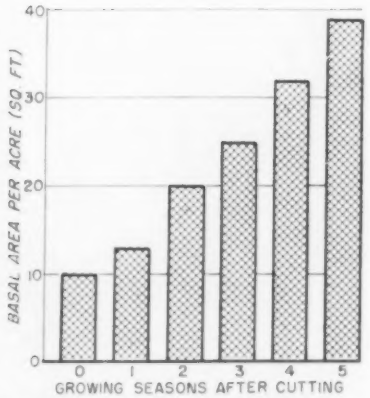

FIG. 3.—Basal area in the sawlogs-only treatment.

fore pruning. By 1959, crown diameters had grown back to about 16 feet in the two heavily thinned treatments. The controls did not begin to expand until the 1957 thinning; then the crown diameter of average crop trees increased to about 9 feet by 1959. The crown-height ratio remained at about 55 percent during the whole 5-year period.

Roots.—The rate and extent of root development were estimated for the crop trees in the sawlogs-only treatment. Root growth was followed by measuring soil-moisture depletion at various depths and distances from the stems of crop trees. Where soil moisture was depleted below field capacity, it was assumed that pine roots were present in proportion to the amount of depletion, after herbaceous water use and surface evaporation were taken into account.

Samples taken immediately after thinning in 1954 indicated that roots at a depth of 24 inches were largely concentrated within a radius of 3 feet from the stem. At shallower depths, roots extended farther—up to 8 feet. Only an estimated 10 percent of the ground area was utilized at the beginning of the 1954 season. By the end of the second growing season, 1955, about 30 percent was more or less fully occupied. At the end of the third year, 1956, 60 percent of the area was occupied. After 5 years the surface 24 inches was considered nearly 100 percent utilized by pine roots from the 100 crop trees per acre.

In the early summer of 1956, halfway through the third growing season after thinning, lateral roots of randomly selected crop trees in both the sawlogs-only and control treatments were excavated and diagrammed. Figure 5 compares lateral distribution, in the 0- to 6-inch depth, of roots 1/16-inch in diameter and larger. Excavations at lower depths showed similar patterns.

After 2½ years of complete release, the longest laterals of the sawlogs-only trees had grown to twice the extent of those of the control crop trees. In the surface 6 inches, roots of sawlogs-only trees rather fully occupied about 200 percent more soil area per tree than roots of controls. At lower depths the concentration and growth of roots were not as great, but were still in the same proportion for the two treatments.

Soil moisture.—Availability of soil moisture always influences the response of trees to thinnings. Soil moisture was thus the one site factor studied intensively. A typical growing season in the 5-year period was that of 1956, during which moisture levels under the three treatments were closely measured.

Gravimetric samples were taken to a depth of 3 feet at weekly intervals during the early part of the growing season. Later, as the soil became dry, the sampling intervals were lengthened to two and then three weeks. Sampling points were randomly located at distances of about 4 feet from crop trees on all plots. This procedure was preferred to a normal area-wide sample because it insured that all samples were taken from soil in contact with crop-tree roots.

Total available water was plotted over time for all treatments (Fig. 6). The general rates of moisture depletion were inversely

TABLE 1.—STAND CHANGES PER ACRE, 1954-1959[1]

Treatment	1954		1957		1959—
	Before cut	After cut	Before cut	After cut	Residual
	Basal area *Square feet*				
Sawlogs-only	71	10	(2)	(2)	39
Sawlogs-pulpwood	70	31	65	29	46
Control	74	74	124	85	104
	Stems *Number*				
Sawlogs-only	1,020	100	(2)	(2)	100
Sawlogs-pulpwood	1,099	452	439	187	187
Control	1,183	1,183	1,147	712	712

[1]Prior to growing season.
[2]Not cut.

proportional to the intensity of thinning. Soil on the control plots dried very rapidly, nearing the wilting point by July. Soil moisture in the other two treatments did not reach low levels until much later.

In 1956, diameter growth on the control plots stopped when about half of the available water had been depleted (Fig. 6). This moisture level represented a soil-moisture tension of about 3 atmospheres. In the control plots, the sampling points were representative of soil moisture throughout the stand, for roots thoroughly occupied the soil. In the other treatments, roots incompletely occupied the soil, and moisture tensions at the 4-foot sampling points were more severe than at greater distances from the stem. At the periphery of roots in the sawlogs-only treatment, the soil was near field capacity throughout the entire 1956 growing season.

FIG. 4.—*Left:* Crown form typical of crop trees in sawlogs-only plots before pruning in March 1957. *Right:* A control tree in March 1957. Neighbors of the control tree have been removed for purposes of the photograph.

Discussion

The growth response to normal thinnings in even-aged pine stands is short-lived, for the released soil and crown space is soon filled by the residual trees. With complete release, as attempted by the radical thinnings in this study, the growth stimulus might be expected to continue indefinitely. However, complete freedom to grow was not maintained for more than a few years, even with the widest spacing tested.

Sawlogs-only treatment.—Diameter growth was well correlated with root and crown development. Figure 7 diagrams the over-all growth of an average sawlogs-only crop tree in relation to its neighbors. After the stand had been reduced to 10 square feet of basal area in 1954, crop-trees expanded roots and crowns freely. Lateral root competition probably did not begin until the third growing season (1956), but by the end of the fifth season roots were occupying all of the soil space in the surface two feet.

Annual diameter growth of the sawlogs-only trees did not correlate well with summer rainfall (June through September):

Year	Sawlogs-only diameter growth	Summer rainfall (4 months)
	Inches	
1954	0.7	5.0
1955	1.1	12.0
1956	0.7	11.0
1957	0.9	22.0
1958	0.8	26.0

Best growth occurred the second year after thinning, while the trees were still competition-free and were building up large crowns and roots. Rainfall that season was only moderate. But when rainfall was more abundant during the last two seasons, root competition had increased, resulting in somewhat less growth during the wetter years.

The sawlogs-only trees made measurable diameter growth for about 9 months of each year (Fig. 2). Soil moisture was evidently adequate throughout the growing season, even though by late summer moisture near each tree was at a relatively low level (Fig. 6). Much of the water absorbed by these trees was probably entering roots at greater distances from the stem, where roots were more sparsely developed but growing into moister soil. With root competition among neighboring trees becoming more intense each season, however, soil moisture depletion in the future should be more nearly uniform at all distances from the stem.

The large diameter-growth response was expected with the build-up in crowns and roots. Height growth, however, was no better on the free-to-grow trees than on the crowded plots where thinning was deferred. Height growth of southern pines is notably unaffected by wide differences in stand density.

If height growth is not increased by wide spacing, the crop trees at age 30 will yield only two sawlogs, even though diameters may be of harvesting size. Trees may look short and stout. However, the volume of 50 "short" trees per acre could well total 15,000 board

feet, because pruning improves form. Not counting the volume of trees removed in thinnings prior to age 30, this would be an average annual growth rate of 500 board feet per acre from date of planting.

Figure 3 indicates no slowing down of basal area growth because of increasing competition. Periodic thinning of the crop trees to maintain rapid diameter growth, however, will in turn reduce total basal area. It may be 10 years or more before total basal area on the sawlogs-only plots reaches the 85 square feet of the control plots.

Sawlogs-pulpwood treatment.— In some aspects, this treatment is more desirable than the sawlogs-only. During the early years it utilizes soil space more fully, although pulpwood stems obviously compete with the crop trees. At the end of the fifth year, diameters were a full inch less and crowns a little narrower than in the sawlogs-only treatment, but for the loss of an inch in diameter there is the gain of about 9 cords of pulpwood per acre in this study.

The second thinning, in February 1957, reduced the basal area of the sawlogs-pulpwood plots to 29 square feet per acre—very close to the 25 feet then on the sawlogs-only plots. The next thinning will probably remove the remainder of the pulpwood trees, leaving this treatment essentially like that of the sawlogs-only, but with crop trees somewhat smaller in diameter.

Control treatment.— In well-stocked young pine stands in the Midsouth, soil moisture becomes limiting to diameter growth nearly every growing season. The control trees made 75 percent of the year's diameter growth by early summer, with about half of the growing season still remaining. At this stage the stored water in the soil is gone and trees stop growing, except when rain temporarily recharges the soil.

As evidenced by Figure 2, the light thinning of 1957 accelerated diameter growth only slightly. Since summer rainfall was twice as heavy after thinning as before, as much of the increase could be attributed to the rain as to the thinning.

Apart from the sawlog objective, there is no question that area-wide cubic volume growth was several times greater on the control plots than in either of the other treatments. There were, of course, ten trees in the control treatment for every one in the sawlogs-only and for every five in the sawlogs-pulpwood plots.

Wood quality aspects.—Rapidly grown trees cut when young will be of lower-than-average density, since specific gravity is in part a function of age.[1] Low-density southern pine wood of uniform gravity is satisfactory for mill work, trim, or other products in which machinability and gluing and finishing characteristics are of paramount importance. The lack of uniformity shown in Figure 8 could probably be overcome by having the trees widely spaced from the seedling stage.[2]

Determinations of wood specific gravity, proportion of summerwood, and abundance of reaction wood cells on wood samples from crop trees of the sawlogs-only and control treatments were made at the U. S. Forest Products Laboratory in 1958. Specific gravity averaged about 0.45 and summerwood about 35 percent for both treatments. Both values are typical for young loblolly pine. As figure 8 indicates, reaction wood bands formed in sawlogs-only trees in-

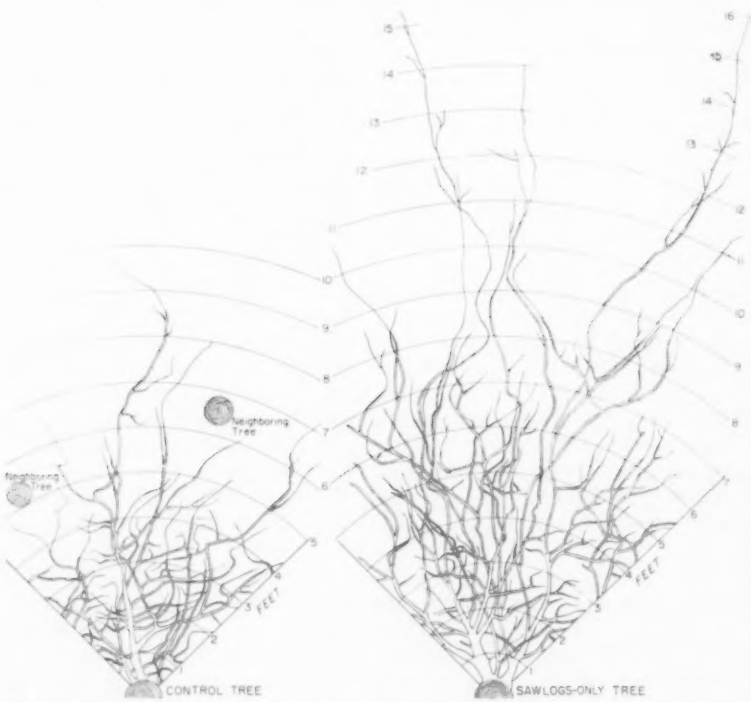

FIG. 5.—Distribution of lateral roots with diameters 1/16 inch and larger in the surface 6 inches of soil around typical crop trees of control (*left*) and sawlogs-only (*right*) treatments. Excavated during 1956 growing season.

[1]Turnbull, John M. Some factors affecting wood density in pine stems. Jour. South African Forestry Assoc. No. 16, 22-43. Illus. 1948.

Larson, P. R. Effects of environment on the percentage of summerwood and specific gravity of slash pine. Yale Univ. Forestry Bul. 63. 89 pp. Illus. 1957.

Zobel, Bruce J., and Robert L. McElwee. Natural variation in wood specific gravity of loblolly pine, and an analysis of contributing factors. TAPPI 41(4): 158-161. Illus. 1958.

[2]The present study is therefore not an adequate test of the wide-spacing and rapid-growth philosophy developed in other parts of the world, notably South Africa. See, for example, I. J. Craib, The silviculture of exotic conifers in South Africa. Jour. South African Forestry Assoc. No. 15, 11-45. 1947.

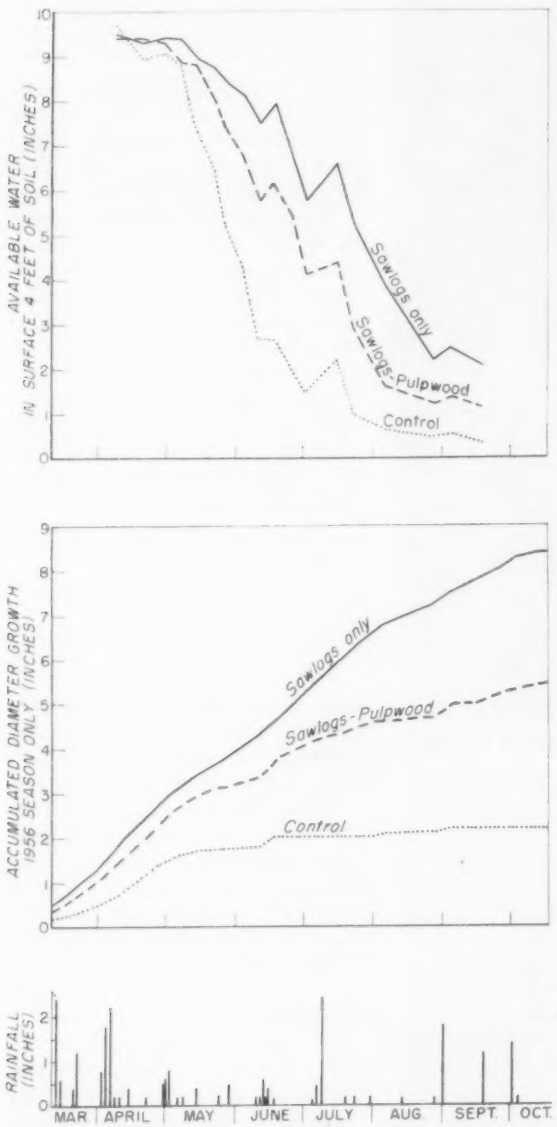

FIG. 6.—Trends of soil moisture depletion (above) and diameter growth (below) for the 1956 growing season. Each point on the soil-moisture curve is based on 27 field observations, and each point on the growth curve represents the average of 12 trees.

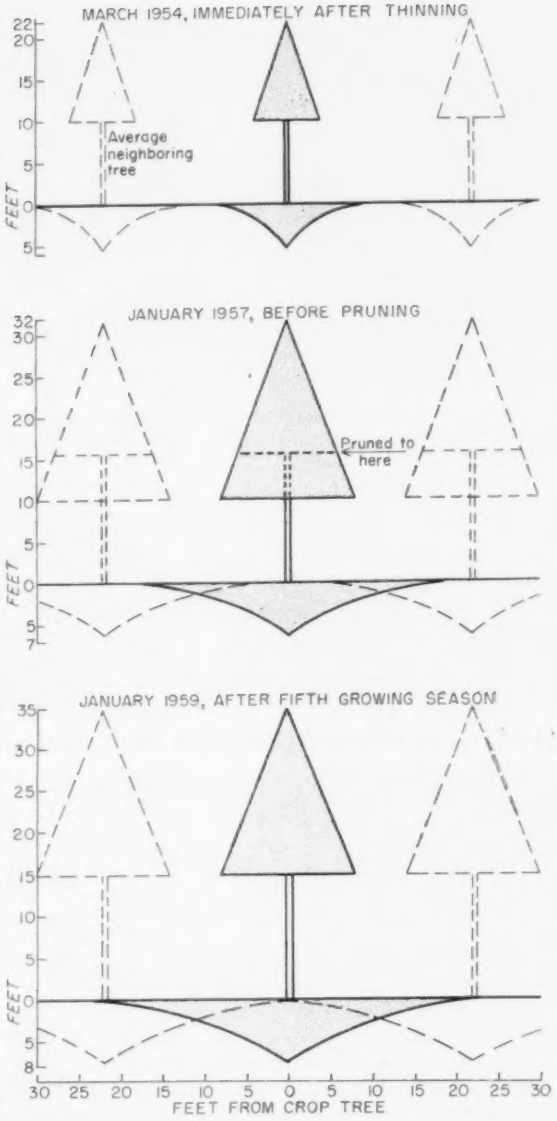

FIG. 7.—Development of average sawlogs-only crop tree in relation to neighboring crop trees. Crown, stem, and roots drawn to same scale.

mediately after thinning, presumably because of excessive wind sway when the plots were opened up. By 1957, reaction wood cells were no more abundant in sawlogs-only wood than in controls, indicating that stem-wood production had stabilized.

Summary

In 1954, a 9-year-old loblolly pine plantation was radically thinned to test the feasibility of growing sawlogs on a short rotation.

In one treatment (sawlogs-only) the plantation was thinned to 100 crop trees per acre. A second treatment (sawlogs-pulpwood) removed all trees whose crowns were within 5 feet of the crowns of 100 crop trees per acre; a pulpwood thinning in 1957 again released the crop trees. In both treatments, about 50 trees will remain for the final sawlog harvest. The crop trees are pruned periodically.

The control treatment is thinning from below to 85 square feet of basal area at 3-year intervals, with no pruning.

Diameter growth in the 5 years since 1954 has been 4.3 inches for the sawlogs-only, 3.4 inches for the sawlogs-pulpwood, and 1.9 inches for the control treatments. Growth

FIG. 8.—Cross section of a sawlogs-only tree cut after the end of the 1957 growing season, showing growth rings typical in this treatment.

was related to crown and root development and to available soil moisture.

The widely spaced trees made diameter growth into late fall each year, while the controls ceased growth by midsummer, when they had depleted soil moisture.

Trees in the heavily thinned plots were free to grow unhindered for the first few years after treatment, but their roots quickly filled the available soil area and they were no longer competition-free at the end of 5 years.

Height-growth was not stimulated by the heavy thinnings. The wood of the heavily thinned trees has normal density for young loblolly pine.

Variation In Areal Disturbance Produced By Harvesting Methods In Ponderosa Pine

Harold F. Haupt

SOME disturbance of the forest floor, primarily the baring of soil by tree felling, log skidding and bunching, and by road building, is inevitable in timber harvesting operations. The extent and kind of soil disturbance incidental to logging ponderosa pine lands of the West are especially important because unnecessary disturbance not only takes land out of tree production temporarily or permanently; but these logged lands may also become sources of damaging runoff and sediment.

Measurements of the area bared by harvesting activities were made on 838 acres of the Boise Basin Experimental Forest near Idaho City, Idaho, in 1954 and 1955. This experimental forest typifies much of the pine land of central and southern Idaho; it has steep slopes, a loose sandy soil derived from granite, and a dominant forest cover of old-growth ponderosa pine (*Pinus ponderosa* Laws).

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The Survey

Silvicultural.—The portion of the experimental forest included in this study was harvested in 1953 and 1954.[1] [2] The operating area included 16 logging compartments that varied in area from 30 to 78 acres. Each compartment, usually a minor drainage, was further divided into three "timber volume-class areas" or subplots,[3] each including a minimum of 10 acres. Most of the high volume subplots were in the lower portion of the drainage and had initial stands of 20 M board feet or more per acre. Medium volume subplots, with initial stands of 10-20 M board feet per acre, occurred on intermediate slopes. Most of the low volume subplots were along ridges and had initial volumes of 10 M board feet per acre or less.

Individual immature, mature, and overmature trees of high mortality risk were marked for cutting by stem selection, on eight compartments. On the other eight compartments, usually mature or overmature trees were cut in groups, and occasionally single trees between these groups that were extremely high insect risks were also cut. Stem selection method resulted in a wide distribution of harvested trees, whereas group selection restricted cutting generally to small clumps (Fig. 1).

Under each cutting method, four

[1] Curtis, James D. A study of ponderosa pine production in central Idaho. Intermountain Forest and Range Expt. Sta. Misc. Pub. No. 4. 9 pp. illus. 1955.

[2] Curtis, James D., and Alvin K. Wilson. A test of group selection in Idaho ponderosa pine. Jour. Forestry 56: 182-189. 1958.

[3] The alternate term "subplot" was not used in the Curtis-Wilson reports, but it is used exclusively in this report so as not to confuse the reader when referring to "area bared" in a "timber volume-class area."

compartments were marked to leave a low reserve of timber, and four were marked to leave a high reserve. However, because six of the low volume subplots had initial stands too low in volume to permit marking to the high level of reserve prescribed for the volume class, only 42 of the 48 volume subplots were marked for cutting, and included in the survey area.

Logging was done with small D-4 type tractors on eight compartments, and with large D-8 type tractors on the other eight.

The operated area thus provided opportunity to observe and measure the area of disturbance produced by two kinds of cutting methods at two levels of reserve volume, and by two sizes of logging tractors, each condition superimposed on entire compartments of three initial volumes, except for the six low volume subplots noted above.

Measurement of bared area.— Measurements showing the type and extent of areal disturbance by logging were obtained by a complete survey. Truck haul roads were chained,[4] assigned an average width of 25 feet, and plotted on large-scale topographic maps. Areas bared by log bunching or landings were paced, referenced to an adjoining road, and also plotted. Lengths of each skidtrail, tractor turning space in the vicinity of felled trees, and ground depression caused by a felled tree were then sketched on the maps; contour lines (at 50-foot intervals) and plotted roads were used as reference points. Widths of each skidding and associated disturbance were paced at several locations and the average used to compute area.

Degree of surface bareness was determined arbitrarily by classifying the areal disturbance as showing exposure of more or less than 50 percent of mineral soil. Haul roads and landings,[5] and all but about one-tenth of the skidding and associated disturbance were in the "more than 50 percent" class. The small area on which less than 50

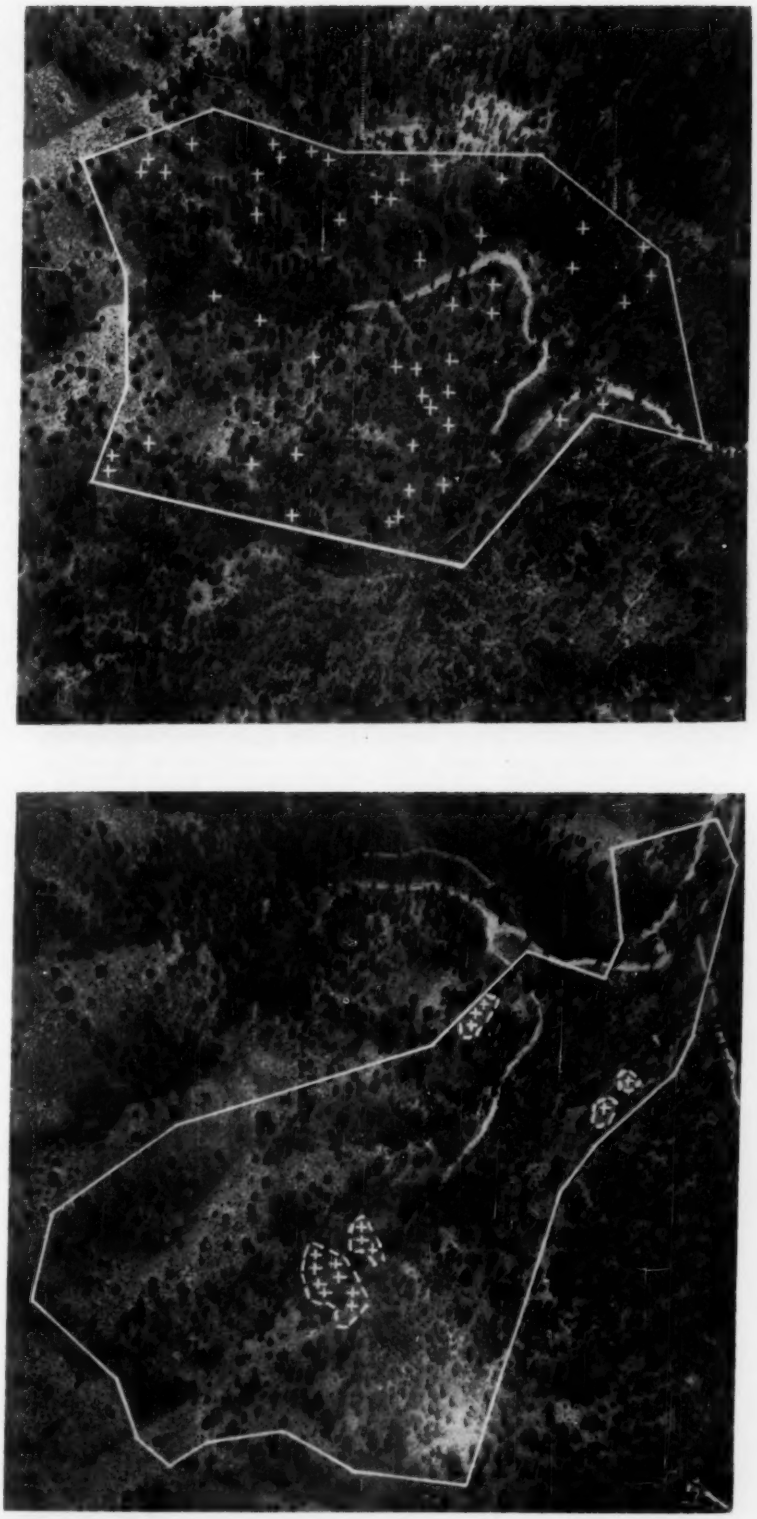

FIG. 1.—Stem selection compartment (*above*) and group selection compartment (*below*) cut and logged in the Boise Basin Experimental Forest, Idaho City, Idaho. 1954.

[4] Road survey directed by Alvin K. Wilson, Intermountain Forest and Range Expt. Sta.

percent of the mineral soil was exposed was well distributed over all compartments and was assumed to be too small to affect analyses significantly; however, it was not excluded from the subplot totals. Tractor disturbance was disregarded if it had caused no discernible exposure of mineral soil.[5]

Bared areas were finally computed as acres per square mile of volume subplot area. Timber harvest volumes were also determined and computed as M board feet and number of trees per square mile of volume subplot area.

Treatment Effects in Baring Soil

Gross effects.—Bared soil averaged 52 acres per square mile for all cutting and logging treatments, or 8.1 percent of the total area (Table 1). This amount of areal disturbance was evenly divided between haul roads and skidtrails. When tractor sizes are considered separately, however, the areas bared for roads and skidtrails are markedly different. When large D-8 type tractors were used, disturbance from skidding was almost twice that of road disturbance (34 acres against 19 acres per sq. mile); for small D-4 type tractors, the effect was reversed (17 acres against 33 acres per sq. mile).

Other differences among major treatments are apparent in Table 1, but the most striking results are the differences in soil disturbance among initial volume classes. Total bared area (haul roads plus skidtrails) increased from 20 acres per sq. mile for the low initial volume subplots to 78 acres for the high volume subplots. Trail disturbance alone increased 100 percent from 16 acres per sq. mile to 32 acres from low volume to high volume subplots. Road area increased more than 11 times from low to high (4 acres to 46 acres per sq. mile).

The gross differences between road and skidtrail disturbance by initial volume classes can be explained, in part, by the location of the volume class areas within compartments. Low volume subplots, without exception, were at higher elevations and on generally more nearly level terrain such as ridge tops and basins at the head of draws. They were suited to tractor skidding because of topography and location at the end of the road, where there was no need for the road to continue through them. High volume subplots were closer to the main road and generally more accessible to it as well as to the secondary logging roads that traversed them. Medium volume subplots were intermediate between these two. Skidding distances for logged trees, consequently, were generally much shorter in the subplots having heavier volume.

The apparent effect of volume of timber harvest on total bared area, as well as on areas bared by different kinds of disturbance among initial volume subplots, readily suggested a regression analysis in which disturbance by timber removed could be compared among all major treatments. Without such an analysis, the major treatment effects were partially obscured, because even within the same initial volume class equal volumes were not cut in all compartments, although they were cut to the same reserve volume.

Correlation analyses were made first between soil area bared and timber volume removed and soil area bared and number of trees removed. Although coefficients of determination for each cutting method were high, that between bared soil and numbers of trees removed was somewhat greater, as shown below:

	Coefficient of determination r^2
Stem selection cutting	
Trees removed per sq. mile	.951
Volume cut per sq. mile	.913
Group selection cutting	
Trees removed per sq. mile	.918
Volume cut per sq. mile	.909

Consequently, in the regression analysis, number of trees was the independent variable. Before this test was made, some subplots were combined because timber cut in one plot had been skidded across another; thus, the relationship between trees cut and skidding damage was partially obscured. One subplot was omitted because it contained a long dozer-constructed skidtrail, the only trail of its kind in the operating area. Thirty-eight plots or combinations were used in the final analysis.

Effects on total bared soil area.—The relative influence of stem selection cutting and group cutting on total bared area is illustrated in Figure 2. As would be expected, an increase in intensity of timber removal under either system of tree harvesting increases the amount of soil disturbance. This increase is significantly greater when single stem selection is used. Increasing tree harvest by stem selection cutting from 1,500 to 6,500 stems per square mile increased bared area from 29 acres to 114 acres per square mile, or from 5 to 18 percent of the area. Under similar intensities of group cutting, the range was from 29 to 84 acres, or from 5 to 13 percent of the area. The greater increase in disturbed

[5] In subsequent portions of this report, haul road and landing disturbance may be referred to collectively as "haul roads" or "haul road disturbance"; skidding and associated disturbance as "skidtrails" or "skidding disturance."

TABLE 1.—AVERAGE AREAS OF BARED SOIL AND VOLUME OF TIMBER HARVESTED FOR ALL COMPARTMENTS, BY MAJOR TREATMENTS, AND BY INITIAL VOLUME CLASSES

	Volume class	Bared area			Timber harvested	
	Subplots	Skidtrail	Haul road	Total		
	Number	*Acres per sq. mile*			*Trees per sq. mile*	*M/fbm./ sq. mile*
All compartments	42	26	26	52	3,140	3,556
Stem selection	21	28	28	56	3,106	3,844
Group selection	21	25	23	48	3,175	3,267
Large tractor	22	34	19	53	2,973	3,720
Small tractor	20	17	33	50	3,325	3,374
High reserve	18	25	28	53	2,665	3,049
Low reserve	24	27	24	51	3,497	3,935
Low initial volume	10	16	4	20	1,203	1,529
Medium initial volume	16	26	20	46	3,044	3,577
High initial volume	16	32	46	78	4,447	4,801

area under stem selection is attributed to greater dispersion of felled trees and less repeat usage of skidtrails and haul roads.

It would be unwise to extrapolate this trend beyond the removal of 6,500 stems per square mile. On a theoretical basis, further intensified cutting by either system may show a leveling off in the rate of increase of bared area. Under stem selection this leveling may be reached when a fairly complete and uniform network of skidtrails exists over an area and makes it economical to reuse more trails. Under group selection this level may be attained when the boundary of one group closely approaches that of another group and permits intergroup use of established trails.

Other paired regressions showed how use of small and large tractors affected the total amount of bared area. The pair for stem selection cutting showed no significant difference in regression coefficients and a difference in adjusted means that was significant. This indicates that expected disturbance from both sizes of tractors may increase at the same rate with increased timber harvest; however, the amount of bared area for any given intensity of cut may be slightly greater for large tractors. When the same comparison was made for group selection cutting, no significant difference was found in the predicted rate or amount of disturbance between areas where small and large tractors were used. It appears, therefore, that different sizes of tractors exert less influence on the total amount of soil disturbance than do the two cutting methods.

Effects on component amounts of bared area.—The average effects of small and large tractors on areas of soil bared on haul roads and skidtrails used in stem selection cutting is shown in Figure 3. The paired lines reveal that logging with a small tractor causes a definite increase in area bared by construction of haul roads with intensified timber cutting; whereas, there is no significant increase in skidtrail disturbance—this remains fixed at about 12 acres per square mile. Logging with a large tractor, on the other hand, shows reversed trends, for the area bared by haul roads remains constant at about 26 acres per square mile, while that of skidtrails increases sharply when cutting is increased. These differences related to tractor sizes probably reflect the physical

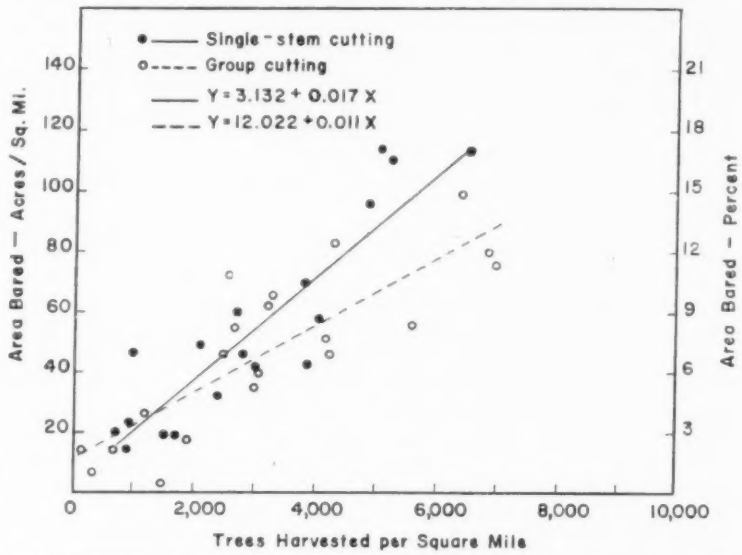

FIG. 2.—Relation of soil disturbance to intensity of harvest of ponderosa pine under two selection cutting systems.

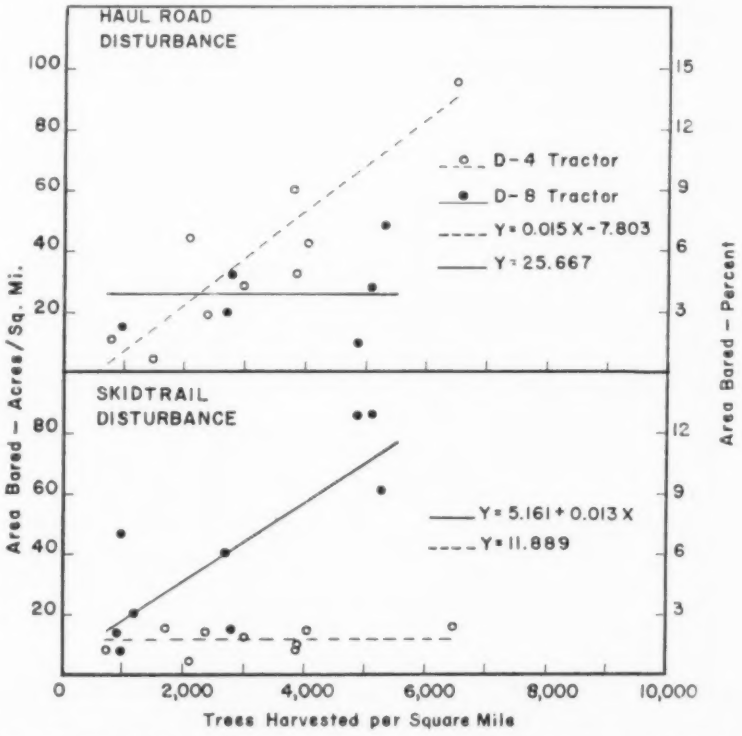

FIG. 3.—Effects of large and small logging tractors on the relation of soil disturbance from haul roads and skidtrails to the intensity of harvest cutting ponderosa pine by stem selection.

difficulties involved in skidding logs on rugged terrain. Apparently, the logging operator relied upon an extended haul road system in order to place the landings closer to logs to be skidded rather than use the small tractor to skid widely dispersed logs any great distance to landings.

These same relative effects of tractor size were not readily apparent on group selection compartments. There the evidence indicates that haul road and skidding disturbance of a similar magnitude may be expected from both large and small tractors (Fig. 4). This apparent lack of difference in disturbance produced by different sized tractors may be related more closely to the economics of logging than to the physical limitations of skidding equipment. It may indicate that it is good logging practice to position the landings as close as possible to the groups of felled logs and maintain a minimum length of skidtrails leading from the areas to the landings. This will not necessarily maintain the over-all skidding area disturbance to a given level as timber cut is increased to 7,000 stems per square mile (Fig. 4). Actually, as amount of timber removed increases, the group areas increase in number or size or both. In each group area, the amount of tractor turning (skidding) area disturbance will increase on a per unit area basis regardless of the proximity of landings and haul roads.

Significance of Findings

The number of trees harvested from a given area is the key factor affecting the amount of soil bared. Where the number of trees harvested varies from 1,500 to 6,500 stems per square mile, the silvicultural method of cutting—either stem selection or group selection—has additional influence on total area of soil bared. But under stem selection the size of tractor used in logging also determines whether the major portion of bared area is in the form of skidding, or haul road disturbance. Consequently, these findings provide a method of predicting areal disturbance under two methods of cutting and logging.

Prior knowledge of the extent and origin of soil disturbance may be useful in planning certain management practices and avoiding others. In regenerating ponderosa pine, baring soil and removing grass and shrub competition are prerequisite to successful establishment. Considerable skidding disturbance requires little or no additional site preparation immediately after logging. A few skidtrails are excluded as regeneration areas because of unfavorable site location or because of probable reuse in future logging operations. Nearly all haul road disturbance is of this class, and even those roads which will be untraveled usually offer inhospitable sites for pine regeneration.

Although taken out of tree production, haul roads become permanent parts of a transportation system and may contribute to management by virtue of their future function. In central Idaho, the first cutting in old-growth pine generally requires construction of a dense network of roads for removal of numerous risk trees. This initial density of roads must be adequate, but should not be excessive. Results of the present study indicate rather conclusively that excessive haul road disturbance is associated with use of small tractors in stem selection cutting. For example, removal of 5,000 trees per square mile requires that an average of about 10 percent of the area be occupied by haul roads and landings, as compared to about 4 percent when large tractors are used (Fig. 3). The difference of 6 percent represents a sizable area that would be saved for productive purposes if skidding with a more powerful tractor were substituted for a smaller tractor. However, the deleterious effects from use of a less powerful tractor would not necessarily prevail on group selection areas.

To maintain high quality water yields from ponderosa pine lands, sediment movement resulting from logging disturbance must be held to a practical minimum. To achieve

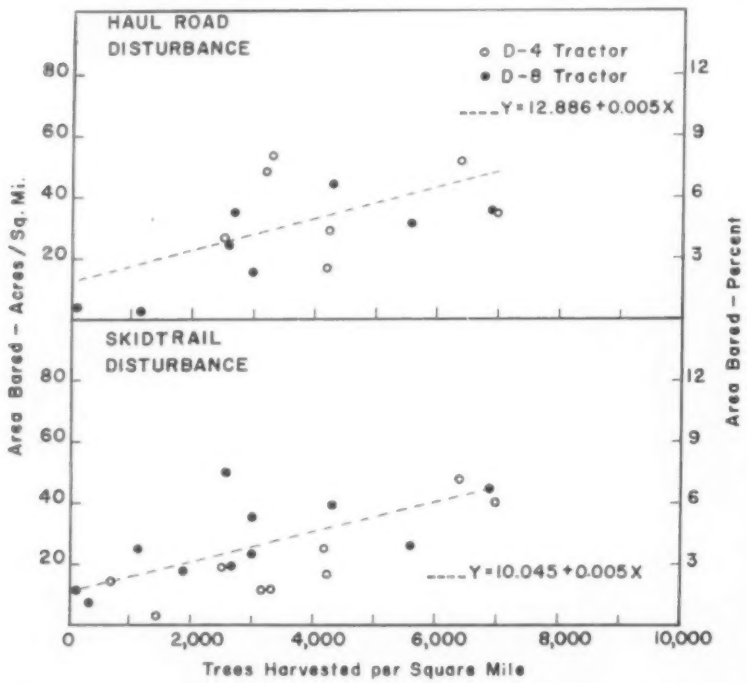

FIG. 4.—Combined effects of large and small logging tractors on the relation of soil bared from haul roads and skidtrails to the intensity of harvest cutting ponderosa pine by group selection.

this goal, most surfaces disturbed by skidding are treated after logging to reduce overland flow and scouring. Treatment consists mainly of constructing retention and diversion structures from logging debris or by using hand shovel and bulldozer. Close spacing of these structures usually precludes the need for revegetating with grass cover and, hence, increases the chances for successful tree regeneration. When treated in this manner, skidding disturbance seldom contributes damaging sediment.

Haul road disturbance must be dealt with more intensively if the watershed goal is to be achieved. Because the density of merchantable stems is greatest on lower slopes and bottom lands, many roads traverse much of the lower slope near the stream channel before climbing to higher elevations. The total road system exposes large surface areas on which seepage and surface runoff normally concentrate. As the collected water flows off the road surface and downslope, it may induce severe erosion. Narrow undisturbed strips left to protect the stream channel may be inadequate to dissipate road sediment.[6] Under such circumstances corrective treatment should include cross drains on the road, supplemented by sediment retardants below the road,[7] prior to reseeding. This treatment prevents road sediment from reaching a stream channel, but it is also costly. For this reason, excessive haul road disturbance should be avoided, partly because it may damage a watershed; partly because it does not contribute necessarily to silvicultural management.

[6]Haupt, Harold F. Road and slope characteristics affecting sediment movement from logging roads. Jour. Forestry 57:329-332. 1959.

[7]Haupt, Harold F. A method for controlling sediment from logging roads. Intermountain Forest and Range Expt. Sta. Misc. Pub. 22. 22 pp. Illus. 1959.

Summary

The area of soil bared by harvesting timber on 16 compartments on the Boise Basin Experimental Forest is closely related to the number and volume of trees removed. Timber was harvested by the stem selection method of reproduction on eight compartments; group selection was used on the other eight. As the intensity of timber cut by single tree selection and group selection increased from 1,500 to 6,500 trees per square mile, the area of soil bared increased from 29 to 114 acres and from 29 to 84 acres per square mile, respectively. Greater tree dispersion and less repeat usage of skidtrails and haul roads account for more bared soil in single tree harvesting compartments. In group selection tractor size showed no significant difference in areal disturbance. Results of this study indicate that group selection timber cutting caused less soil disturbance than single tree selection in this central Idaho area.

The Cover

"Rainier Vista" at the University of Washington in Seattle, scene of the Fifth World Forestry Congress. In the background is majestic Mt. Rainier, a 14,410-foot peak of the Cascade Mountains, about 100 miles from Seattle. The Tudor-Gothic architecture of the 600-acre campus is shown in the Suzzalo Memorial Library (left) and the Administration Building (right). Between the two buildings is Frost Pond, where forestry students conduct log-rolling contests each year.

New York Life Presents *the 42nd in a Series of Advertisements to Help Guide Young People to a Better Future*

Should your child be a Forester?

by FREDERICK K. WEYERHAEUSER

Chairman, Weyerhaeuser Company, as told to Donald Robinson

IT TAKES bulldog courage to succeed as a forester. Plus a deep abiding faith in the future.

Every day a forester has to fight for the lives of his trees. No sooner does he put a fragile, little seedling into the ground than a rodent may gnaw off its budding branches. Before the tree attains young maturity, a bear may rip away its bark.

Disease may strike the tree at any age, and destructive insects can prey on it. A windstorm can uproot it. A forest fire may make a blackened corpse of it.

The forester has all these enemies to contend with, and more. He has continually to pit his scientific knowledge and skill against what sometimes seem to be insuperable odds. Even if he wins, he may never see the end results of his struggles. It can be 100 years until the trees he plants have grown tall enough for logging.

But to the right sort of man there are great joys in the profession of forestry. Take Jeff Harris, a veteran forester in the Northwest.

Harris was sent into a section of Oregon that had been swept by a hideous forest fire. For miles nothing could be seen but angry ashes and the gaunt skeletons of dead trees.

He didn't despair. The moment entry into the area was safe, he organized teams of high school boys and with their help hand-planted over 14,000 acres with new trees. That was in 1940.

The other day, Harris flew over the same section. Not a scar left by the fire was visible. The entire vista was green with growing trees.

"Boy, it felt good to see that land lookin' green," Harris said. "Makes a fellow mighty happy to think he can help a dead forest come back to life."

Protector of Vital Resources

Foresters are the key men today in preserving this nation's proudest heritage—our 664,000,000 acres of forest land.

Foresters are also the key men in one of the nation's largest, most important industries—timber products. For we should remember that forests exist to be used. We must have their products to live.

Today some 489,000,000 acres of forest area are in commercial use. The federal government, the states, and local governments own and harvest commercially twenty-seven percent, about 132,000,000 acres. The remaining 357,000,000 acres are owned and harvested privately.

These forests support an industry with no less than 1,640,000 employees and a volume of $25,000,000,000 a year! Out of the forests come the world's oldest and newest products: lumber for construction and furniture; paper for printing and 1,000 additional purposes; cellulose for ammunition, and photographic film; pharmaceuticals; sugar, ethyl alcohol, plastics, and countless more.

Many and Varied Duties

The forester's part in all this is to help the forests to grow and see that they are wisely used. His function has been well defined as "the scientific management of forests and forest lands."

It's an enormous job. Each forester must be able to survey forest areas, build roads, determine the volume of trees in an area and estimate how fast they are growing—no easy assignment when millions of trees are involved. He must supervise the cutting of timber, and the reforestation that follows it.

He must know treatments for tree diseases, and ways to beat back rampaging insects. Right now, a tiny killer called the balsam woolly aphid is sucking the life out of hundreds of thousands of beautiful white fir trees in Washington and Oregon. It's a pathetic sight.

But we have hope of a solution. Foresters have found a special fly in Czechoslovakia that feeds on these aphids. They've rushed them over and set them to work in our woods. Results have been most encouraging.

The forester must know repellents for defending forests against animal damage. He must know means of safeguarding forests against the hazards of wind and snow. Most of all, he must know methods for preventing forest fires, and for fighting them if those grim horrors get going.

The Need for Foresters

The demand for qualified foresters is something startling. They number 17,000 already, and it's not enough. The forty colleges of forestry graduated 1,470 young men last year, and more jobs were available than were people to fill them. Approximately 5,000 foresters are employed by the U.S. Forest Service to work the national forests, manage forest ranges, and supervise recreational facilities. More foresters are hired by the National Park Service and other federal agencies.

About 2,000 foresters are employed by states, counties and municipalities to run public-owned forests, direct fire control operations, and assist small owners who cannot afford foresters of their own.

Then there are the 9,000 or so foresters in private industry. They can be found in every part of the country, growing trees and profits. Because of the nature of their employment, their duties tend to be more varied than are those of government men.

Some 200 foresters have set up as private consultants, and most are doing very well. Eight hundred are engaged in college teaching.

Opportunities for promotion are excellent in all fields. In government service, one goes from timber cruiser to district forest ranger and on up to be chief of forestry for a state or the federal government.

In industry, within ten years one can be a branch forester and have personal charge of 500,000 acres. From there the next step is managing forester with responsibility for millions of acres.

Forestry can also be a stepping stone to advancement in other lines, such as sales, public relations, administration, education.

The pay? It is not as high in the early years as it is in some other professions. However, it should be adequate, especially when it is recognized that young foresters are usually stationed in small towns.

In the U.S. Forest Service, the salaries go from $4,490 to $17,500. State salaries generally begin a little above the federal.

A forester who goes into industry can anticipate $4,200 to $5,400 to commence. Research men with graduate degrees will do better; they'll begin at $6,000 to $7,500. Later on, if they're of outstanding calibre, industrial foresters may draw $15,000 to $20,000. Successful private consultants can earn more.

Special Rewards

But the attraction of forestry is not money. It is the beauty, physical and spiritual, of the outdoors. It is the pleasure of working with living things, and the thrill of growing majestic trees that may last for generations. It is the clean, vigorous healthy life. Look at any old-time forester. You'll be amazed at his youthful vigor.

It is the chance to travel. "I never dreamed I'd be seeing so much of the world," a young forester wrote me. He'd been working in India and now he was en route to Brazil.

This forester, dressed in protective clothing, is evaluating an insecticide. Through such research, foresters find better ways to control tree diseases and insect damage.

As part of his scientific management of forests, the forester must supervise the cutting of timber so as to make the most efficient use of these important resources.

It is the superb sense of comradeship that comes from serving with other dedicated men.

There is a darker side to the coin, of course. The work can be hard, dirty, cold, wet, exhausting. And dangerous. The hours are long and irregular. A forester is frequently away from home for days on end.

It can be very trying on his family. The wife of a forester I know gave birth to two children in the past seven years, and her husband could not be with her in either case. He was off fighting fires.

"I didn't blame him," the poor woman said, "but I sure missed him."

Living in a small town, miles from anywhere, with limited recreational facilities, can be very hard, too. So is the constant shifting from one post to another.

The question arises as to how you can tell if a boy has the makings of a future forester.

He should have a deep love for nature and the outdoors. He should have a strong physique and enjoy roughing it. He should be the sort of a lad who keeps his head in emergencies.

I'm thinking here of a forester who was ringed in by a raging forest fire. He didn't panic. He buried himself in the ground until the fire passed overhead, and escaped unscathed.

Certainly, each prospective forester must have a generous stock of patience and optimism. He should be able to get along with people, and express himself well on his feet. He'll be doing a lot of public speaking to conservation groups. He must be a keen student, especially in the sciences.

College Essential

At least a four year college course is now required to become a forester. A boy planning such a career would be wise to study as much mathematics and English in high school as possible. Not long ago, the University of Washington conducted a survey to see why some forestry students failed to graduate.

In almost every instance, it was due to inadequate preparation in mathematics and English.

Does this profession have room for women? A few, perhaps, in the research laboratories. In the main, it's a man's job. Over the course of the past fifty years, many girls have enrolled in the University of Washington's College of Forestry. Only two ever succeeded in graduating. Neither is still practicing forestry.

They have done the next best thing. They married foresters.

ABOUT THIS ARTICLE...

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An Appraisal of the Value of Five Grass Species For Seeding Skid Roads and Log Landings in Western North Carolina

Theodore S. Seely

THE IMPORTANCE of establishing grass on skid and logging roads has become increasingly apparent in recent years[1,2]. This vegetation serves many useful purposes; soil stabilization is one, and control of water runoff another. Deer, rabbits, and game birds benefit by the production of forage and accompanying insect life. Aesthetic values are increased where logging roads are adjacent to highways or near recreation areas. In addition, seeded roads remain in good condition for fire control and may be used for logging operations during the next cutting cycle.

For several years the seeding of disturbed areas has been a general practice on the North Carolina National Forests (Fig. 1). The limited success in some instances of skid-road seeding prompted the establishment of an administrative study in 1955 on the Pisgah District involving the use of several promising grass species in conjunction with lime and fertilizer treatments. The objectives were to appraise, by observation, the relative success of establishment and longevity of several grasses for seeding skid trails and log landings. No attempt was made to determine the value of grass species or treatments for soil stabilization, soil improvement, or game food production.

Methods of Study

A 3,000-foot section of skid road in the Bent Creek Experimental Forest was used in this study. The degree of slope varied from slight to the maximum grade negotiable with a D-6 crawler-type tractor (about 40 percent). The skid trail averaged about 10 feet in width with a northerly aspect.

Three series of five plots were laid out. Each plot was two hundred feet long and, based on a 10-foot average width of the skid trail, contained about 0.046 of an acre. The first series of five plots was treated with both lime and 2-12-12 fertilizer, the second with lime only, and the third received neither lime nor fertilizer. Fertilizer was applied at a rate of one-half ton per acre, and lime at a rate of one ton per acre. Individual plots in each series were seeded with one of five grass species (selection of the species for each plot was random): (1) meadow fescue, *Festuca edatior* var. Ky.-31; (2) hard fescue, *Festuca ovina* var. *duriuscula;* (3) shade fescue, *Festuca rubra* var. *heterophylla;* (4) bulbour bluegrass, *Poa bulboso;* (5) Kentucky bluegrass, *Poa pratensis.*

Seed was applied at a rate of 20 pounds per acre in order to assure ample seed on all plots.

Equipment used was a D-6 crawler-type tractor, a trailer for hauling fertilizer and lime, a chain-

FIG. 1.—A good grass cover on a logging road not only alleviates erosion, but also provides food and cover for wildlife and enhances aesthetic values.

THE AUTHOR is district ranger, U. S. Forest Service, Pisgah District, North Carolina National Forests, Pisgah Forest, N. C. He wishes to express appreciation to the personnel of the Southeastern Forest Expt. Sta. for aid in analysis and presentation.

[1]Edwards, M. G. Habitat improvement proves useful in forest wildlife management. Wildlife in N. C. 18 (12):8-9, 16-17. 1954.

[2]Morriss, D. J. Correlation of wildlife management with other uses on the Pisgah National Forest. Jour. Forestry 52: 419-422. 1954.

TABLE 1.—RANKED ORDER OF SUCCESS OF ESTABLISHMENT, GROWTH, AND DENSITY OF COVER OF FIVE GRASS SPECIES BY SITE TREATMENT FOR THREE PERIODS OF OBSERVATION AFTER SEEDING

Ranked order	First growing season 1955			Second growing season 1956			Fourth growing season 1958		
	Limed & fertilized	Limed	Untreated	Limed & fertilized	Limed	Untreated	Limed & fertilized	Limed	Untreated
1	Meadow fescue	Meadow fescue	Meadow fescue	Shade fescue	Shade fescue	Shade fescue	Shade fescue	Shade fescue	Shade fescue
2	Kentucky bluegrass	Kentucky bluegrass	Shade fescue	Hard fescue	Hard fescue	Hard fescue	Hard fescue	Hard fescue	Hard fescue
3	Shade fescue	Shade fescue	Kentucky bluegrass	Meadow fescue	Meadow fescue	No growth	Kentucky bluegrass	No growth	No growth
4	Hard fescue	Hard fescue	No growth	Kentucky bluegrass	No growth	No growth	Meadow fescue	No growth	No growth
5	Bulbous bluegrass	No growth	No growth	No growth	No growth	No growth	No growth	No growth	No growth

type spike tooth harrow for site preparation, and a cyclone seeder.

The entire operation required approximately 20 man-hours of labor and an equal time for a tractor driver. Additional time by supervisory personnel was used to lay out the study. Normally, such supervisory time would be negligible.

Results

Observations were taken in the late summers of 1955 and 1956, and again in the fall of 1958 on the relative success of establishment, growth, and density of ground cover. These criteria were used to develop a ranked list (Table 1) of the five species for each type of treatment and period of observation.

It may be seen from Table 1 that after the first growing season, several shifts in the ranking of species occurred. It was observed at the end of the first growing season (late in the summer of 1955) that seedings of meadow fescue (Ky. 31) and Kentucky bluegrass produced excellent stands on both the fertilized-limed plots and the limed-only plots. In the same treatment series, shade fescue and hard fescue seedings produced very light stands. The stand of bulbous bluegrass in the limed-fertilized series developed in the early summer, but had died-back by the first period of observation. No stand of bulbous bluegrass was evident on the limed plot. Untreated plots of meadow fescue and shade fescue had fairly good stands. The bluegrass plot produced a light stand, and no stands of bulbous bluegrass or hard fescue were apparent on untreated plots.

Results of the observations in 1956 and 1958 were about the same. Ranked orders in Table 1 indicate that shade fescue subsequently developed the best stands, and surpassed other species throughout the period of study in all plots. Hard fescue was ranked upward into second place, although it was not as outstanding as shade fescue. Both of these species required a second growing season to develop fully, but apparently did very well on untreated plots as well as on those that were treated. After the second season, stands of both meadow fescue and Kentucky bluegrass gradually died out. Stands of bulbous bluegrass never became established except temporarily during the first growing season and then only on the fertilized-limed plot.

Four years after seeding, good stands of shade fescue were present on all plots regardless of treatment. As its name implies, this species is very tolerant to shade, and apparently requires considerably less fertilizer and lime than other species tested. These are important considerations where extensive log road and landing rehabilitation is planned, since the use of shade fescue would reduce cost and enhance success considerably. Palatability of this forage and its value as a food for deer is not known. Likewise, no attempt was made to determine the value of this and other grasses for other wildlife species. It is anticipated that where high-quality forage is desirable for wildlife, seed mixtures could be employed. The results of these preliminary tests suggest, however, that shade fescue might be used as a valuable component of such seed mixtures.

Notes and Observations

Academy-Research Council to Investigate Insecticide-Wildlife Relationships

The National Academy of Sciences-National Research Council has announced formation of a new committee to investigate the relationship between chemical control of agricultural and forest pests and conservation of America's wildlife populations.

In a letter of appointment to members of the new Committee on Pest Control-Wildlife Relationships, Dr. Detlev W. Bronk, president of the Academy, notes: "This committee is being established to undertake the task of encouraging cooperation and harmonious relations in this increasingly important and somewhat controversial field of agriculture."

The creation of the committee, which will function within the Division of Biology and Agriculture, is the most recent of several steps taken by the Academy-Research Council during the past few years in response to concern expressed in several quarters over use of chemicals to control agricultural pests.

The over-all problem of pesticide use was set forth in mid-1959 by an *ad hoc* committee appointed by the Academy-Research Council. The committee reported that expanded use of newly discovered chemical controls had resulted in significant gains in agricultural production and in public health. At the same time, however, numbers of some desirable wildlife may have been reduced.

In January, 1960, the Academy-Research Council sponsored a conference to explore the challenge further. Noted then was a grievous lack of objective data; some persons responsible for pest-control programs tended to minimize the injurious effects of the chemicals they use, while some conservationists tended to maximize such damage. It was further noted that "In every case there may be a happy medium in which effective plant protection can be obtained without lasting damage to useful animals."

The new committee, in search of an optimum, will

1. provide technical advice and guidance to bring about maximum control of crop pests with minimum damage to wildlife;

2. provide critical evaluation of both the direct and indirect effects of various pest control operations on plants and animals;

3. stimulate new research where gaps exist, and encourage investigations in progress to obtain factual information as a basis for sound guiding principles and policy determinations; and

4. foster cooperation among various agencies, organizations, industries, and individuals interested in pest control and those concerned with its effects on fish and wildlife.

The members of the new committee are: Chairman, Dr. Ira L. Baldwin, special assistant to the president of the University of Wisconsin; also Dr. Ira N. Gabrielson, president of the Wildlife Management Institute; Dr. Tom Gill, executive director of the Charles Lathrop Pack Forestry Foundation; Dr. George L. McNew, managing director of Boyce Thompson Institute; Dr. E. C. Young, professor of economics and dean of the graduate school, Purdue University; and Dr. G. C. Decker, entomologist, Illinois Natural History Survey. Dr. W. H. Larrimer of the Academy-Research Council will serve as the executive secretary of the committee.

An Efficient Method of Taking Large Increment Cores

A joint research project between North Carolina State College and Southlands Experiment Forest of International Paper Company has been initiated to investigate heritability patterns in loblolly pine. The project involves the controlled pollination and complete description of 320 randomly chosen trees. One of the important phases of this project includes the study of wood characteristics which requires that two 8 mm. and one 10 mm. diameter increment cores be taken from each parent tree.

Because of the time and effort required for extracting the many cores needed for the study, it was necessary to devise some method that would be less time-consuming and easier than the conventional procedure. Use of the ratchet-equipped handle as designed by Duffield[1] and the borer starter described by Echols[2] was helpful, but the process was still exceedingly laborious.

Southlands Experiment Forest had a trailer-mounted electric generator (Fig. 1) which was originally designed for electric welding in the field. A one-inch AC-DC electric drill was found to have a "no-load" speed of 370 rpm, which did not seem excessive. A $\frac{9}{16}$ inch, 8-point socket was brazed to a drill shank to hold the 8 mm. diameter borer bit. The shoulder of the bit was filed slightly to fit the $\frac{9}{16}$ inch socket.

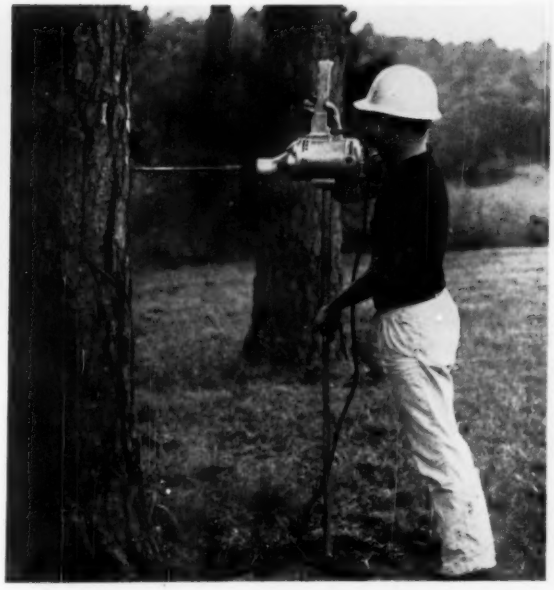
This set of equipment was tested and found to drive the bit into

[1]Duffield, John W. A ratchet wrench for over-size increment borers. For. Science 3:21. 1957.

[2]Echols, Robert M. Variation in tracheid length and wood density in geographic races of scotch pine. Yale University: School of Forestry Bull. No. 64, 16. 1958.

Above

FIG. 1.—Equipment for taking increment cores mechanically. Drill and stand ride between generator and fender when changing positions.



Right

FIG. 2.—Position for starting increment borer.

the tree effortlessly. A $\frac{5}{8}$ inch, 8-point socket was then welded to a second drill shank and the drill tested with the 10 mm. increment borer bit. This larger bit penetrated as easily as the 8 mm. bit.

An adjustable stand was constructed, using lightweight pipe and a flat steel base which made it possible to take all cores at the $4\frac{1}{2}$ foot level regardless of slope.

In operation, the bit of the increment borer was placed in the drill chuck and started into the tree by applying pressure to the handle of the drill (Fig. 2). After a full day's work it was found that the bit was somewhat difficult to start. Apparently, this was due to the fact that the bits of the increment borers became dull after a number of cores were taken. This difficulty was eliminated by honing the bits after each day's use.

Once the bit was started into the tree, it was necessary to push the stand toward the tree in order to keep the socket on the bit. The bits were backed out of the tree by hand using the ratchet-equipped handle.

A good ground was maintained at all times while the drill was in operation. To accomplish this, a $\frac{3}{16}$ inch brass welding rod was soldered to an insulated wire which was attached to the drill frame. Prior to starting the generator, the rod was forced into the ground.

This operation was fairly efficient. Two men averaged taking three cores from approximately 40 trees in about six hours' working time. This included moving from tree to tree, and in some cases the trees were quite scattered. Taking cores with the drill approximately halved the time required to take the same number of cores by hand labor. The efficiency of this method could no doubt be speeded up by using a reversible drill to back the bits out. The quality of the cores taken, using the drill, was excellent and no damage to the bits of the increment borers was noted.

In the particular situation at Southlands Experiment Forest, the drill and portable generator were available, and the trees to be studied were fairly accessible. This equipment can readily be used in cases where a large number of cores must be taken in a fairly well-localized area. However, the use of a jeep or tractor-mounted portable generator would make the method more adaptable for work in more inaccessible areas.

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Seasonal Rooting Responses of Slash and Loblolly Pine Cuttings

Plant men have long recognized that season of collection influences rooting response of cuttings of many species. It has been suggested by Mergen[1] that late October to early November is the best period to collect slash pine cuttings for maximum rooting. His air-layering work and that of Hoekstra[2] with the same species have amply demonstrated that time of preparation markedly affects rooting.

A study was initiated to determine the effect of season on the rooting response of cuttings of loblolly pine (*Pinus taeda* L.) and slash pine (*P. elliottii var. elliottii* Little and Dorman) and to ascertain the best time of year to collect material. Subsequent studies designed to investigate the physiology related to this phenomenon are necessary and have been begun. This report is confined to the rooting of cuttings collected throughout an entire year.

As previous studies of aging have shown that cuttings from old trees of the species considered do not root,[3] trees two to three years old were used as sources. At each collection date all source trees were the same age.

Cuttings from leaders of these trees were collected monthly starting in January, 1958, and ending January, 1959. They were trimmed to uniform size, approximately eight inches long, and wounded at the base by slicing two inches of bark from one side of the cutting. Three treatments—talc formulations of 0.3 percent indolebutyric acid (IBA), Rootone, and a control—were employed in each of three replications. Forty-five cuttings of each species were planted each month.

Fermate was dusted on the surface of a sand medium which was then soaked with water in advance of planting. Cuttings were planted in flats and placed in the greenhouse without shading. No attempt was made to control either duration or quality of light or temperature. However, ventilation without benefit of fan or other mechanical device was enhanced where possible to reduce high midday temperatures. Heating cables in the benches compensated for the relatively low temperatures of water used in misting. A misting schedule of one minute "on" and five minutes "off" was employed.

Examination of cuttings and final collection was made five months after planting. Two categories were recognized, namely those which had produced roots and those which had not.

Statistical analysis reveals that month, species, and treatment were highly significant in accounting for the variation in rooting re-

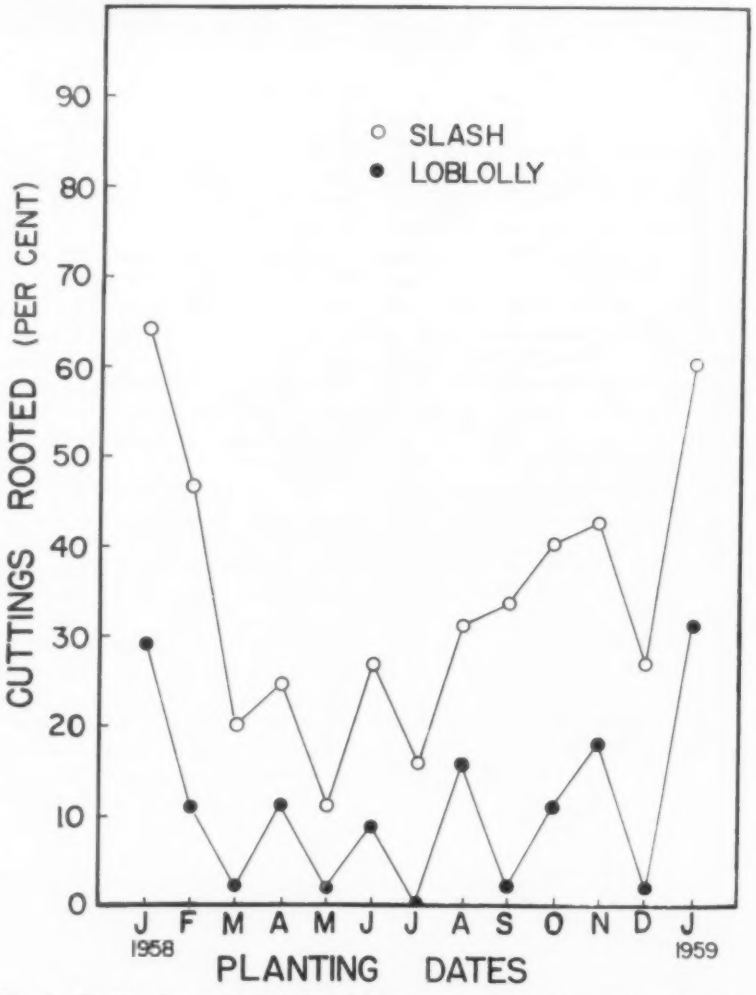

FIG. 1.—Rooting (percent) of slash and loblolly pine cuttings for each month over an entire year (all treatments).

[1]Mergen, F. Vegetative propagation of slash pine. Southeastern Forest Expt. Sta. Station Paper 54. 1955.

[2]Hoekstra, P. E. Air-layering of slash pine. Forest Sci. 3:344-349. 1957.

[3]Reines, M., and J. T. Greene. Forest genetics at the George Foster Peabody School of Forestry, University of Georgia. Progress Report 1956-1957. Report No. 5, Georgia Forest Research Council. 1958.

TABLE 1.—RANGE OF MONTHS IN ORDER OF SIGNIFICANCE

Month	Significance
May[1]	
July	None
March	None
December	None
September	None
June	Significant
April	Significant
August	Highly significant
October	Highly significant
February	Highly significant
November	Highly significant
January (1958)	Highly significant
January (1959)	Highly significant

[1]Base month

sponse. The peak response in rooting took place in January, falling off to a low in May, after which the trend was upward (Fig. 1). Similar peaks have been observed in previous unrelated studies. The drop in the December, 1958, planting cannot be accounted for, and on the basis of previous observation represents aberrant behavior. Further analysis using the Duncan Range Test shows the range of months in order of significance (Table 1).

Species differences were obvious. Slash cuttings at all times rooted more readily than those of loblolly pine. The analysis shows that differences between species were highly significant.

Treatment differences were significant. The Duncan Range Test for testing between means reveals that rooting responses to Rootone and IBA were better than that of the untreated control. Rootone was better than IBA.

None of the interactions computed were significant.

The seasonal results suggest to us that a relationship to some annual cyclic sequence of events may exist. Food storage and consumption during the dormant and growing seasons respectively may be involved and rooting may be best when the food supply is highest. Differences in species performance would not necessarily reflect differences in food reserves but rather an innately diverse intermediary metabolism affecting the capacities of their living cells to reproduce mitotically. This, of course, requires verification.

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This work was done as part of a project of the University of Georgia College of Agriculture Experiment Station in cooperation with the Georgia Forest Research Council and the Georgia Forestry Commission.

The European Pine Shoot Moth: Relationship Between Proportion of Trees Infested and Number of Insects Per Tree

Where trees are uniform in size and distribution, as they usually are in plantations, one might suppose that the density of a pine-feeding insect would be reflected by the proportion of trees affected, or vice versa. During several recent studies of the European pine shoot moth (*Rhyacionia buoliana* [Schiff.]) carried on by the author and his co-workers in Michigan, much information was collected which can be brought to bear on this question.

The data were obtained between 1956 and 1958 from 69 sampling areas in 20 plantations in Lower Michigan. The trees in these plantations ranged between 3 and 7 feet tall; all were spaced at 6×6 feet, and none had reached crown closure. Most of the samples (85 percent) were taken in red pine (*Pinus resinosa* Ait.). Other species sampled included Scotch pine (*Pinus silvestris* L.) (5 percent), Eastern white (*P. strobus* L.) (3 percent), jack (*P. banksiana* Lamb.) (3 percent), Austrian (*P. nigra* Arn.) (2 percent), and ponderosa (*P. ponderosa* Laws.) (2 percent).

Insect population counts were made between April and June during late larval and pupal stages. From 10 to 60 trees were taken in each sampling area for proportion of trees infested and from 3 to 30 infested trees for number of insects per tree. Several sampling methods were used: trees were taken successively in a row; alternately in a row; every fifth in every fifth row; or every tenth in every tenth row. Final values for number of insects per tree were computed by multiplying the proportion of trees infested by the mean number of insects per infested tree. A plantation with 50 percent of trees infested and a mean of 2 insects per infested tree would thus have an over-all average of 1 insect per tree.

Values for number of insects per tree were graphically plotted on proportion of trees infested. It was clear at once that, where all trees in the sample were infested, infestation intensities generally exceeded 7 insects per tree (33 sampling points with 8 to 38 insects per tree). At less than 100 percent of trees infested, the relationship between proportion of trees infested and number of insects per tree was exponential (Fig. 1).

Weighted averages were used in making Figure 1 so that each point represented about 10 trees. Thus an area where 30 trees had been sampled for both proportion of trees infested and intensity of infestation became three 10-tree samples. The larger samples were not always in multiples of 10, however; sample sizes for points in Figure 1 actually average out to 15 for proportion of trees infested and 9 for number of insects per tree.

The formula $y = ab^x$ reduced to logarithmic form was used to fit the regression line in Figure 1. Since the standard error of log b (.002) is small in comparison to log b (.01868), the regression of y on x is statistically significant.

In shoot moth infestations, determining proportion of trees infested is easier and quicker than counting number of insects per tree. Therefore, the relationship suggests a rapid method for estimating shoot moth population levels when the proportion of trees infested is known. In 6×6-foot plantations with trees between 3 feet tall and crown closure, a sample of as few as 15 trees should provide the necessary index for obtaining a number-of-insects-per-tree reading from Figure 1. Coordinates obtained with each of the sampling methods used were about equally scattered on the diagram, so it seems likely that any of these methods could be used in practice. However, every fifth tree in every fifth row would probably give the most representative sample with the least effort.

WILLIAM E. MILLER
Lake States Forest Experiment Station, Forest Service, U. S. Department of Agriculture, St. Paul, Minn.

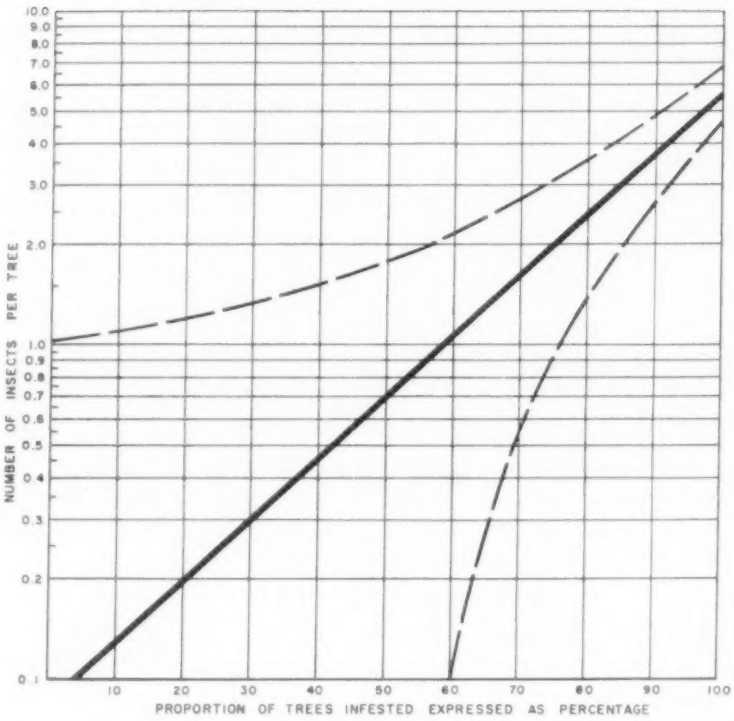

FIG. 1.—Regression of number of insects per tree on proportion of trees infested. The trend line is a graphic presentation of the equation $\log y = -1.0884 + 0.01868\ x$. The standard error of y is 0.58. Broken lines indicate the 95-percent confidence band.

Further Results of Bud and Twig Pruning of Loblolly Pine[1]

Following the appearance of papers by Bickerstaff (*1*), Curtis (*3*), and Paul (*5*) on the method of pruning advocated by Krotkevich (*4*) known variously as debudding, finger budding or bud and twig pruning, an experiment was planned to test the applicability of the method to loblolly pine in the Duke Forest located in the lower Piedmont of North Carolina.

The objects of the experiments were to determine the effect of this treatment on (1) rate of height and diameter growth, (2) change in form, (3) relative value of the final product, and (4) whether the results might be influenced by spacing.

The experiment was initiated in a six-year-old loblolly pine plantation on Orange silt loam soil having a soil site index of 69 for loblolly pine. This plantation followed the clearcutting of a mature, even-aged stand of shortleaf pine during the winter of 1943-1944.

The experiment was set up with four replications of the following six treatment-spacing combinations:

1. Complete lateral bud and twig pruning with 7×7 foot spacing.
2. Lateral buds and all twigs pruned, except that the lowest complete whorl was left, with 7×7 foot spacing.
3. Control (no pruning) with 7×7 foot spacing.
4. Complete lateral bud and twig pruning with 14×14 foot spacing.
5. Lateral buds and twigs pruned, except that the lowest complete whorl was left, with 14×14 foot spacing.
6. Control (no pruning) with 14×14 foot spacing.

The required 24 plots were laid out in the field and all hardwoods within seven feet of the plots were cut and their stumps were "am-

[1]Prof. Kenneth L. Carvell, Division of Forestry, West Virginia University, assisted materially in the early work on the project while a part-time assistant in the Duke School of Forestry and offered constructive suggestions on the manuscript.

TABLE 1.—AVERAGE DIAMETER AND HEIGHT GROWTH OF THE TREES USED IN THE BUD AND TWIG PRUNING EXPERIMENT

	Trees spaced 7 × 7 feet			Trees spaced 14 × 14 feet		
	Control (no treatment)	Pruned, leaving basal whorl	Pruned completely	Control (no treatment)	Pruned, leaving basal whorl	Pruned completely
D.b.h. (inches)						
1951	1.08	1.17	0.85	0.84	1.07	0.79
1955	2.80	1.76	1.08	2.98	1.84	1.19
Growth 1951-1955	1.72	0.59	0.23	2.14	0.77	0.40
Adjusted d.b.h. growth	1.84	0.58	0.23	2.14	0.87	0.52
Height (feet)						
1951	6.96	7.69	6.02	5.99	6.98	5.96
1955	16.57	15.80	11.97	14.14	14.68	12.44
Growth 1951-1955	9.61	8.11	5.95	8.15	7.70	6.48
Adjusted height growth 1951-1955[1]	9.3	8.3	7.5	8.7	7.7	6.9

[1]The actual diameter and height growth adjusted for the difference in the heights of the trees at the beginning of the experiment in 1951.

mated" to prevent sprouting. In addition all shortleaf pines, eastern red cedars, and all loblolly pines not needed in the experiment were removed. Also overtopping pines and hardwoods, left as remnants of the previous stand, were cut or frilled and "ammated."[2]

The treatments were then applied to plots randomly selected in the office. Each plot contained nine trees arranged in three rows with three numbered trees in each row. Pruning shears or clippers were used to remove the twigs. Each twig was cut as close as possible to the stem. The first pruning was made in the spring of 1952 just after the buds began to swell which facilitated their location and removal. The same treatments were repeated each of the three following springs just before appreciable terminal growth occurred. The diameters at breast-height and total heights were measured each autumn until 1955 when the experiment was terminated earlier than originally planned because of epicormic branching and the development of excessive crookedness in most of the pruned trees.

Incidental observations deemed worthy of record were made on the pruned trees as follows:

1. Leaving the basal whorl on some of the trees did not reduce the quality of the wood in the knot-free portion of the stem from which the first log would be cut since the knots from this whorl are below stump heights. This modification resulted in a marked reduction in feathering out from adventitious buds along the bole and reduced the amount and cost of the necessary follow-up work.

2. The bud and twig pruned trees retained old needles for several years after they would normally be shed. These needles were longer than the average on the unpruned trees and were denser than those on branches of the unpruned trees.

The results of analyses of the growth data, as summarized in Table 1, show that:

1. For the 7-foot as well as for the 14-foot spacing the height and diameter growth of trees subjected to both types of pruning was significantly less (1 percent level) than that of the control trees.

2. For both spacings the complete bud and twig pruning was inferior to that with the basal whorl left unpruned. The difference in height growth was significant at the 5-percent level, while the difference in diameter growth was significant at the 1-percent level.

3. For all three types of pruning the height growth of trees with the 14-foot spacing was significantly less (5-percent level) than that of the trees with the 7-foot spacing.

4. Regardless of type of pruning the trees spaced 14 feet apart showed significantly greater (1 percent level) diameter growth than did the trees spaced 7 feet apart.

Furthermore the severely pruned trees not only developed very crooked stems but also an excessive number of epicormic branches rendering them very undesirable components of a possible future stand. Their development was very similar to that shown by Brender (*2*) in his Figures 1 and 2.

Because of the undesirable results obtained the authors agree with Brender that loblolly pine is definitely not suited for bud and twig pruning. These severe prunings reduce very drastically the photosynthetic capacity of the treated trees and consequent assimilation of the foods, thus resulting in the decreased growth in height as well as diameter.

[2]Treated with an aqueous solution of ammonium sulfamate.

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Points of View

Comments on "Licensing of Foresters"

We have read with interest Henry I. Baldwin's comments on licensing of foresters in the April, 1960, JOURNAL OF FORESTRY.[1]

Mr. Baldwin has some very good points and has raised certain questions which are deserving of clarification. Since he has specifically mentioned Georgia and the licensing of foresters under the Georgia Registration Law, we believe that Mr. Baldwin's questions can be answered at least in part by giving the Georgia viewpoint.

Mr. Baldwin states: "Apparently there are two purposes that the sponsors of licensing have in mind: (1) to protect the public from incompetence, and foresters from competition of nonforesters doing forestry work, and (2) to enhance the 'professional' standing of graduate foresters." The Georgia law proposes no such thing. The Georgia law under Section 1(d) states and I quote: "It is the purpose of this act to protect the public by improving the standards relative to the practice of professional forestry." There is nothing in the language of this act to lead anyone to believe that foresters need protection from competition from nonforesters, or that foresters need to enhance the "professional" standing of graduate foresters. Professional foresters in Georgia do not fear competition from nonforesters or anyone else. We stand on our professional competence and are willing to meet competition on any and all terms. The Georgia law was enacted simply to protect the public by improving the standards relative to the practice of professional forestry.

Mr. Baldwin presumes that there must exist some danger or abuses that are expected to be reduced or eliminated by licensing of foresters. He is correct. There are dangers or abuses that are expected to be reduced or eliminated. He, himself, points out the principal danger or abuse when he says in his article, "Is not part of the confusion due to the fact that too many foresters do subprofessional work?" We are in complete accord with Mr. Baldwin in that too many foresters do subprofessional work. We contend that they do subprofessional work because the general public does not know the difference between professional and subprofessional forestry, and this is the danger that we are attempting to overcome here in Georgia.

We are also in complete accord with Mr. Baldwin's remarks that more technicians and probably licensed technicians are needed. We believe that a recognized group of forest technicians to do subprofessional work would go a long way toward clearing up the confusion in the public mind as to the difference between professional and subprofessional forestry. We do not, however, believe that a failure to register the professional group will do anything toward improving this situation.

Continuing on the subject of technicians, we in Georgia do not expect any man who works in the woods to become a forester solely by dint of long experience; no more so than one expects a "law clerk or court stenographer to be admitted to the bar without professional study and a law degree, nor a laboratory technician to become an M. D. solely by dint of long experience." The present Registration Law as amended was passed in February, 1959, a little over a year ago. The present law replaces the older permissive law in that the present law provides in Section 1, Paragraph (a) and (b) "No person shall engage in the practice of professional forestry without first being licensed as a professional forester." The present law had a "grandfather clause." This grandfather clause expired September, 1959. At the present time only a graduate of a school of forestry can register under the Georgia law. Georgia does not at this time permit anyone to become a registered forester who has not a degree of forestry from a school approved by the Board, a specific record of an additional two years or more of experience in forestry work of a character satisfactory to the Board plus recommendations from three registered foresters; or, graduates of schools of forestry not approved by the Board may be licensed after two years' experience of a character satisfactory to the Board and under supervision acceptable to the Board and who shall have successfully passed a written examination, plus recommendations from three registered foresters. In either case, this man must be a graduate of a professional school of forestry.

With regard to the examination, while Mr. Baldwin states the examinations described under the Georgia plan are directed toward the techniques of forestry, in other words, candidates would be tested on their ability as technicians, Georgia law as written states that this examination should be designed to show knowledge and skill approximating that obtained by graduation from a school, college, or department of forestry approved by the Board. There is a difference.

We wonder if Mr. Baldwin has ever taken the Georgia exam, has

[1] Baldwin, Henry I. Licensing of Foresters. Jour. Forestry 58:325-326. 1960.

he ever seen the Georgia exam, and if so, where did he get it?

We would like to restate that Mr. Baldwin has raised some very pertinent points. We think his questions are well taken and we are indeed pleased to be able to offer answers. We differ from Mr. Baldwin in that we believe what is needed in the forestry profession is not so much crusading zeal, but improved standards relative to the practice of professional forestry and some accountability on the part of the professional forester to the general public for his work.

We believe the present Georgia law is a step in that direction.

ERLE T. NEWSOM, JR.,
Chairman, Georgia State Board of Registration for Foresters

Commemorative Postage Stamp For World Forestry Congress

A 4-cent commemorative postage stamp marking the Fifth World Forestry Congress will be first placed on sale August 29, 1960, at Seattle, Wash., and will feature the Congress seal.

The official emblem of the Fifth World Forestry Congress was designed jointly by Maurice H. Eysenburg of the Division of Visual Services, U. S. State Department, and Rudolph Wendelin of the Graphic Arts Division, U. S. Department of Agriculture.

The 4-cent World Forestry Congress commemorative stamp will measure 0.84 by 1.44 inches, arranged vertically, and will be printed in green. Issuance will be in sheets of fifty, and an initial order for 120 million has been placed.

Collectors desiring first day cancellations of the commemorative stamp may send addressed envelopes, together with remittance to cover the cost of the stamps to be affixed, to the Postmaster, Seattle 1, Washington.

A close-fitting enclosure of postal card thickness should be placed in each envelope and the flap either turned in or sealed. The envelope should be addressed low and as far to the left as possible since the stamp is vertical and the pictorial machine cancellation requires a space approximately 3¼ by 2¾ inches.

Envelopes submitted should be of the ordinary letter size and each must be properly addressed. An envelope must not be sent for the return of first-day covers, and orders for covers must not include requests for uncanceled stamps. The outside envelope to the Postmaster should be marked "First-day Covers 4-cent World Forestry Congress stamp."

Book Reviews

Manual of Vegetation Analysis

By Stanley A. Cain and G. M. de Oliveira Castro. 325 pp. Illus. Harper & Brothers, New York. 1959. $7.50.

Through an attempt to apply phytosociological concepts and methods, mostly of north temperate regions, to tropical vegetation in Brazil, and the production of a service manual of concepts and methods, this book evolved. About one-half of the book deals specifically with tropical vegetation, especially of the exceedingly complex tropical rain forest, and it is an important contribution to the sparse literature of that important and interesting subject.

The first four chapters are introductory, taking up, after defining their purposes, floristics, the community, and the major vegetation types of the world, with the tropical rain formation employed as the primary basis of discussion. Chapters 5 to 11 take up in detail the problems and procedures of vegetation analysis, dealing, specifically, with analysis of vegetation, the problems of number, of pattern, and of dominance, the size of sample units, the combining of separate attributes to describe community structure, and concepts important in synthesis. Chapter 12 is concerned with life form and leaf size. A glossary, literature citation of 425 titles, and an index complete the book.

The authors found the rectangular strip plot of sampling the most convenient method in their work in the tropical rain forest, but they emphasize repeatedly that standardized methods are not satisfactory substitutes for experience and common sense. They present, of course, many methods in studying vegetation and, most helpfully, from their experience, discuss these critically as to effective application and where known, the degree of accuracy that can be obtained. Foresters' methods are frequently discussed in the framework of general ecological technique.

Professional foresters and range men, concerned with the selection and organization of techniques for vegetation study, will find this a most useful book. All botanists will find the detailed treatment of the rain forest of absorbing interest.

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Physiology of Forest Trees

By Paul J. Kramer and Theodore T. Kozlowski. 642 pp. and appendix. Illus. McGraw-Hill Book Company, Inc., New York. 1960. $12.50.

The authors of this book are well known to foresters and plant physiologists alike. Dr. Kramer is James B. Duke professor of botany at Duke University, and Dr. Kozlowski is professor of botany at the University of Wisconsin. Both have well-established reputations for their skill in research and their ability to express themselves in a lucid and readable manner.

The urgent need for a book on the physiology of trees is now generally recognized by foresters, horticulturists, and others interested in the growth of woody plants. The senior author, in his earlier writings, was one of the first to emphasize the role of plant physiology in forestry. He and Dr. Kozlowski have forcefully restated these relationships in their introduction, which is well worth reading.

To attempt, as the authors have done, to include within the covers of a single volume a discussion of all the important physiological processes of trees and other woody plants is indeed a formidable undertaking. However, the authors have succeeded remarkably well. They have not only surveyed the literature widely, but also have digested thoughtfully and have provided their chapters with penetrating and stimulating criticisms and suggestions.

The authors' approach, as stated in their preface, is "an ecological one in which emphasis is placed on the effects of environmental conditions on physiological processes of the organism as a whole, rather than a wholly biochemical one in which emphasis is placed on the details of the processes themselves." While the mechanisms of physiological processes are discussed briefly, it is assumed that the reader will have a knowledge of elementry plant physiology.

The text is divided into sixteen chapters, the first being a general introduction and the second a detailed discussion of the structure of a tree and the manner in which its growth occurs. Then follow ten chapters on physiological processes, including photosynthesis, carbohydrate metabolism, nitrogen relations, translocation, mineral nutrition, and water relations. The interrelationships of these physiological processes are considered in the next two chapters on reproduction and seed germination. The final two chapters are devoted to the internal and environmental factors affecting tree growth.

The level of treatment appears to be uniform throughout, and a wealth of data is admirably expressed in tables, graphs, and photographs. Details of sampling and experimental techniques are presented and evaluated in rather brief fashion.

The assumption by the authors that the reader already has some knowledge of the subject leads them to omit discussion of some of the basic principles behind the facts presented. While this was done deliberately to keep the book within one volume, the result is a certain lack of unity and integration of various portions.

In view of the complexity of the problems discussed, it is natural that there are points which a reader might be inclined to question or argue further. Opposing points of view are stated fairly and the authors' position is always made clear. The present reviewer agrees with most of the conclusions but is inclined to disagree with the view that there is no inherent periodicity in root elongation. This, and other minor differences, will doubtless stimulate the search for new evidence and will further the purpose for which the book was written.

The book is provided with a bibliography of over 1,700 items, an appendix of common and scientific names, and subject and author indexes. It is attractive in appearance, with large, clear type and abundant illustrations.

The book should serve many functions. It is perhaps best suited as a text for advanced classes interested in the physiology of woody plants. It will also serve as a valuable source of reference due to its extensive and up-to-date coverage of the literature. Research workers will esteem it for the way in which it directs attention to questions which still need answering.

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First North American Forest Soils Conference September 1958

266 pp. Illus. Agricultural Experiment Station, Michigan State University, East Lansing. $2.

Southern Forest Soils: 8th Annual Forestry Symposium

Ed. by Paul Y. Burns. 132 pp. Illus. Louisiana State University Press, Baton Rouge. 1960. $4.

Here, for forest managers interested in soils, for forest soils specialists, and for student auger-pullers, are two permanent additions for their libraries. Combined, these two proceedings contain 46 papers on forest soils prepared by a list of authors that pretty well makes up a *Who's Who* in their field.

The proceedings of the North American Conference is the larger; it is paper-backed, contains 31 papers, and costs half as much as its hard-backed junior from the South. But both are worth the money.

So much material is contained in these publications that a reviewer can do little more than summarize their tables of contents. In the volume published by Michigan State, six papers review the latest developments and concepts in analytical methods; chemical (Voigt), physical (Gessel), foliar (White), isotype tracer methods (Walker), manometric methods to measure soil respiration (Chase), and a comparison of foliar and soil diagnosis of nutrient deficiencies (Wilde).

Another seven papers deal with interpretation and use of soils information by forest management (Retzer, Lemmon, Ralston, Rudolph, Hills, Deardorff-Lloyd, and Van Eck-Whiteside). Four papers describe soils-site relationships: in Oregon (Dryness-Youngberg), Canada (Lafond), California (Gardner), and Vermont (Farringston-Howard). Problems and procedures in nursery soil management are described for the South (May), Lake States (Robbins), and in reference to overcoming toxicity effects of biocides by applying a sawdust compost (Matsui).

Three deal with specific studies: nitrogen transformation in podzols (Corke) and two papers on soils and plantation growth in New York State (Heiberg-Loewenstein, and Stone-Taylor-Richards-Dement). Two dwell entirely on soil-moisture relationships, one citing available water as the key to site evaluation (White) and one giving techniques for controlling soil moisture for research purposes (Zahner).

Two are syntheses, one describing the relation of geology and soil to forest vegetation (Lutz), and one on mycorrhiza of forest trees (Slankis). Four present still even broader pictures: forestry and forest soils work in Japan, India, and the Philippines (Chandler), and three on forest soil problems, those in the Northwest (Dunford), those of the future (Kellogg), and problems of communication (Locke).

The 15 papers presented at the 8th Annual Forestry Symposium sponsored by the Louisiana State University School of Forestry cover, by title, a narrower field. Three dealt with the properties of southern soils, one by physiographic areas (Lytle), one describing hydrologic functions and properties (Metz), and one describing soil moisture utilization in the upland forest (Zahner).

Six papers dealt with soil-site evaluation (Lemmon, Hodgkins, Applequist, Ralston, Thornton, and Coile). Five described the possibilities and potentialities of increasing forest growth: by fertilizers (Walker), irrigation (Kraus-Bengston, and Broadfoot), drainage (Maki), and one covered forest growth potential (Ostrom). One paper, that resisted classification, discursively and interestingly portrays the development of forest research programs from a broad silvical base from which all factors of the forest environment are considered to succeedingly narrower basic studies to solve specific problems (McDermott-Fletcher).

The two volumes reflect an up-to-date accounting of forest soils work: the widespread interest, the concentration on soil-site productivity and the different approaches, and the exploratory and imaginative consideration of soil amend-

ments to increase productivity. Most interesting were the papers which synthesized the authors' experience and studies; for instance, T. S. Coile's engrossing summary of his almost 30 years of experience in soils-site productivity work and his comments on recent developments, H. J. Lutz's scholarly presentation of geological-soil-vegetation relationships, and Carl Ostrom's thought-provoking review of forest growth potentials. These and several other papers spoke with the authority of hard study and the wisdom of contemplation.

The sponsoring schools may be proud of these meetings, their notable list of contributors, and above all, making the contributors' thinking available to foresters now certain that forest soils do more than support trees and logging roads.

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Patterns of Professional Education

By William J. McGlothlin. 288 pp. G. P. Putnam's Sons, New York. 1960. $6.75.

It may seem strange that this volume is reviewed in the JOURNAL OF FORESTRY since in it the word "forester" appears but once and the word "forestry" never appears at all. In spite of this, the book should be of interest to all foresters concerned with the educational basis of their profession for it provides a frame of reference within which forestry education may be judged.

The study upon which the book is based evolved out of the author's experiences while an associate director of the Southern Regional Education Board, an organization devoted to planning and coordinating higher educational efforts in the South. In this capacity McGlothlin met and discussed problems with educators representing many professions. He was struck by the number of times these individuals asked him how other professions were handling problems of the same or similar types. In some cases he was able to provide the information they sought but in many cases he was unable to answer their questions. This finally led him to the development and carrying out of a study that would yield the desired knowledge.

McGlothlin decided to limit the study to a small group of representative professions. He chose ten: architecture, business administration, engineering, law, medicine, nursing, psychology, social work, teacher education, and veterinary medicine. This choice provides a wide spectrum of conditions.

Although the study was limited to the educational process up to and including the first *professional* degree, there was a wide range in the needed depth of preparation because of the varied levels at which the professions set their minimum requirements. For example, architecture and engineering recognize holders of the bachelor degree as professionals while in psychology a person must have earned the Ph.D. before being considered a professional. The value of this "representative profession" approach becomes apparent when one studies one of the other professions (e.g. forestry) against the backdrop provided by McGlothlin's report. When this is done one cannot help but be struck by the number of instances in which the problems are parallel and how valuable the recorded experience of the other professions could be in solving these problems.

An item discussed in the book that should be of interest to foresters is the problem of acquiring experience on the job prior to full professional status. As institutional instruction moves away from the practical toward the theoretical, some means must be found by which the students may acquire some first-hand experience with actual professional problems.

McGlothlin describes the methods used by the representative professions to meet this problem. It is illuminating to read some of the adverse comments that have been made relative to the solutions in use. These comments may be condensed as follows: (1) most of the work experiences are poorly integrated with the institutional instruction because of the lack of a common administration: (2) few employers are willing and/or able to provide adequate *teaching* supervision over the trainees; and (3) the work done is often of the type assigned to common labor and bears little relation to professional level operations.

This discussion is of significance with respect to forestry since proposals have been made repeatedly that the forestry schools concentrate on the theoretical leaving the practical material to the employer. Theoretically this idea has merit but the experience of the other professions indicates that much thought should be given the problem before plans for a solution are crystallized.

McGlothlin's book was not designed to stir up controversy but rather to provide information. It is descriptive in nature and is easily read. It should prove to be of considerable interest to all those involved in education for the professions, regardless of what the profession might be.

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Publications of Interest

The U. S. Department of the Interior has issued a new bulletin in its Conservation Series. Conservation Bulletin 41, entitled *Highlights in the History of Forest and Related Natural Resource Conservation* by Fred A. Seaton, Secretary of the Interior (35 pages), enumerates by years, from 1783 to 1958, the historical governmental highlights relating to natural resource conservation preceding the establishment of the Department of the Interior and those subsequently relating to the Department.

The bulletin is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for 20 cents.

Current Literature

Compiled by LOIS MCALLISTER, *Assistant Librarian, State University College of Forestry at Syracuse University*
Range Management Section Compiled by NELLIE G. LARSON, *Library, U. S. Department of Agriculture*

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Society Affairs

Officers and Council
1960-1961

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Lafayette, Ind.

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U. S. Forest Service
Federal Building
Missoula, Mont.

Sixtieth Annual Meeting

Society of American Foresters

Washington, D. C., November 13-16, 1960

The forestry profession will celebrate sixty years of organized progress at the annual national meeting of the Society of American Foresters, scheduled for November 13-16 at the Sheraton-Park Hotel in Washingnton, D. C.

The theme will be "Forestry's Expanding Horizons."

More than 1,000 foresters from the United States and Canada are expected. Some 70 papers will be presented at 12 different sessions on subjects ranging from forest tree geneties to wood technology.

Three keynote speakers will be featured. U. S. Forest Service Chief Richard E. McArdle will review the past sixty years of forestry and predict future developments in the profession. William C. Bramble, head of the Department of Forestry and Conservation at Purdue University, will discuss the past sixty years of forestry from the standpoint of its sociological aspects and the future uses of forests. William M. Bailey of International Paper Company will analyze the scientific achievements of professional forestry with special reference to industrial forest management.

At the Society's annual dinner, to be held on the evening of November 16, three special awards will be presented by President Charles A. Connaughton of San Francisco. These are the Sir William Schlich memorial medal and the Gifford Pinchot medal, both given for outstanding contributions to forestry; and the award for achievement in biological research contributing to the advancement of forestry.

President Connaughton has announced that all foresters and friends of forestry everywhere, whether members of the Society or not, are welcome to attend the various sessions and the sixtieth anniversary dinner.

"This 1960 meeting of the SAF follows closely after the Fifth World Forestry Congress scheduled for Seattle in August and September," he said. "These two important gatherings of foresters will emphasize the meritorious services which forestry and professional foresters are rendering to the stability and strength of our nation. Few professions in America have come along as rapidly as has forestry in the past sixty years."

The foresters return to the nation's capital this year for their annual meeting in keeping with a policy of commemorating every decennial anniversary of the Society's founding in Washington, D. C. in 1900.

Ladies Activities

A large enrollment of ladies is expected at the meeting. They will enjoy a full program of special events. The Ladies Committee has arrangements well along and many special surprises await the visitors.

Scheduled events include a conducted

tour on Monday, November 14, to the Custis-Lee Mansion in Arlington National Cemetery, to see the impressive ceremony at the Tomb of the Unknown Soldiers, and to Mount Vernon.

Tuesday, November 15, will feature a special visit to the White House, and an embassy tour concluding with a tea at the Embassy of the West German Republic.

Wednesday, November 16, will include a luncheon at the beautiful Columbia Country Club in suburban Maryland.

The Committee is planning a number of "extras" that will please the visitors and make their visit to the sixtieth anniversary meeting one of the best.

Schedule of Events

Sunday, November 13

SAF Council meeting: morning.

Joint meeting of the Council and Section delegates: afternoon.

Editorial Board, JOURNAL OF FORESTRY: afternoon.

Association of Consulting Foresters: evening.

Monday, November 14

General Session: morning.

Society Affairs Session: afternoon.

Alumni functions (no scheduled SAF meetings): evening.

Motion pictures: evening.

Tuesday, November 15

Division of Silviculture: morning and afternoon.

Division of Forest Products: morning.

H. R. JOSEPHSON. Local Arrangements Chairman.

Division of Economics and Policy: afternoon.

Division of Forest Recreation: morning.

Division of Forest-Wildlife Management: afternoon.

Alumni functions (no scheduled SAF meetings): evening.

Wednesday, November 16

Division of Forest Management: morning and afternoon.

Division of Education: morning.

Division of Range Management: morning.

SAF Council meeting: afternoon.

Division of Watershed Management: afternoon.

SAF dinner and dance: evening.

General Meeting

Monday morning, November 14

Henry J. Malsberger, Chairman
Theme: "Forestry's Expanding Horizons"

1. Welcome by the President, Charles A. Connaughton.
2. "Horizons Unlimited." Richard E. McArdle, U. S. Forest Service, Washington, D. C.
3. "Industry's Effect on Forest Management." William M. Bailey, International Paper Company, Panama City, Fla.
4. "Forestry and Sociologic Changes in the 20th Century." William C. Bramble, Department of Forestry and Conservation, Purdue University, Lafayette, Ind.

Society Affairs Session

Monday afternoon, November 14

Charles A. Connaughton, President
Henry J. Malsberger, Vice President
Henry Clepper, Executive Secretary

1. Report of the President.
2. Report of the Executive Secretary.
3. Report of the Editor of Society publications, Arthur B. Meyer.
4. Report of the Editor of Forest Science, John W. Duffield.
5. Report of the Committee for the Advancement of Forestry Education, Frank H. Kaufert, chairman.
6. Report of the Committee on Civil Service, R. J. Preston, Jr., chairman.
7. Report of the Committee on State Registration and Licensing, Archie E. Patterson, chairman.
8. Report of the Committee on Forestry Research, George M. Jemison, chairman.
9. Report of the Committee on International Relations, V. L. Harper, chairman.

ARTHUR W. GREELEY. General Chairman.

Special Program on Forestry Education

Samuel T. Dana, leader.

This portion of the afternoon session will be devoted to a discussion of forestry education. Participation by the members in the audience is invited.

Division of Silviculture

Tuesday morning, November 15

Jesse H. Buell, Chairman
Paul O. Rudolf, Vice Chairman
Frank W. Woods, Secretary

1. "Loblolly Pine Growth as Related to Site, Age, and Stand Density." Thomas C. Nelson, Southeastern Forest Experiment Station, Asheville, N. C.
2. "Direct-Seeding Comes to the South." William F. Mann, Jr., Southern Forest Experiment Station, Alexandria, La.
3. "Fungi Associated with Viability Losses of Sugar Pine Seed During Cold Storage." Gilbert H. Schubert, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
4. "The Town Creek Ponderosa Pine Plantations." James D. Curtis, Intermountain Forest and Range Experiment Station, Ogden, Utah, and Melvin A. Coonrod, U. S. Forest Service, Ogden, Utah.
5. Division business meeting.

Tuesday afternoon, November 15

1. "Energy Flow Silviculture, a New Concept for Forestry." Frank W. Woods, School of Forestry, Duke University, Durham, N. C.
2. Report of the SAF Committee on Natural Areas. John F. Shanklin, Office of the Secretary, U. S. Department of the Interior, Washington, D. C.

JOHN F. SHANKLIN, Chairman, Program Committee.

3. "Estimating Site Index for Longleaf Pine through Quantitative Evaluation of Associated Vegetation." Earl J. Hodgkins, Department of Forestry, Auburn University, Auburn, Ala.

4. "Factors Affecting the Development and Survival of Sugar Maple Sprouts." Thomas W. Church, Jr., Lake States Forest Experimental Station, St. Paul, Minn.

5. Report of the SAF Committee on Forest Tree Improvement. R. T. Bingham, International Forest and Range Experiment Station, Moscow, Idaho.

6. "Discriminant Analysis of *Pinus thunbergii* × *Pinus densiflora* Hybrids." Francois Mergen and G. M. Furnival, School of Forestry, Yale University, New Haven, Conn.

Division of Forest Products

Tuesday morning, November 15

Rudolph F. Grah, Chairman
Harvey D. Erickson, Vice Chairman
Raymond J. Wood, Secretary
Theme: "The Decade 1960—A Period of Change in Wood Use?"

1. "What Is Ahead in the Lumber Industry?" Arthur F. Muschler, Edward Hines Lumber Company, Chicago, Ill.

2. "What Is Ahead in the Pulp and Paper Industry?" George B. Amidon, Minnesota and Ontario Paper Company, International Falls, Minn.

3. "What Is Ahead in the Plywood and Hardboard Industries?" James Bethel, National Science Foundation, Washington, D. C.

4. "Wood Production and Processing in the Years Ahead." James J. Byrne, Division of Forest Products Research, U. S. Forest Service, Washington, D. C.

5. "Forest Products Mix in a Changing Economy." John A. Zivnuska, School of Forestry, University of California, Berkeley, Calif.

Division of Forest Recreation

Tuesday morning, November 15

William A. Parr, Chairman
Henry A. Harrison, Vice Chairman
Lemuel A. Garrison, Secretary

1. Opening Remarks. William A. Parr, Chairman.

2. "Widening Horizons in Forest Recreation." DeWitt Nelson, California Department of Natural Resources, Sacramento, Calif.

3. "What Should the User Pay for Forest Recreation." John Sieker, Division of Recreation and Land Uses, U. S. Forest Service, Washington, D. C.

4. Panel Discussion: "Recreation for the Future."

Moderator, Francis W. Sargent, Outdoor Recreation Resources Review Commission, Washington, D. C.

Kenneth B. Pomeroy, American Forestry Association, Washington, D. C.

H. W. Camp, Forest Recreation Research, U. S. Forest Service, Washington, D. C.

Allen T. Edmunds, Division of Recreation Resource Planning, National Park Service, Philadelphia, Pa.

Harry R. Woodward, Department of Game, Fish, and Parks, Pierre, S. Dak.

Discussion.

5. Election of officers.

Division of Economics and Policy

Tuesday afternoon, November 15

H. R. Josephson, Chairman
Henry H. Webster, Secretary
Symposium: "Investment Opportunities in Forestry"

1. "Methods for Appraising Investment Opportunities in Forestry." Carl H. Stoltenberg, Department of Forestry, Iowa State University, Ames, Iowa.

2. "How Forest Industries Judge Investment Opportunities." Arthur W. Nelson, Jr., Timber Products Division, Champion Pulp and Paper Company, Hamilton, Ohio.

3. "Timber Investments from the Standpoint of Institutional Lenders." Eli Ferguson, Equitable Life Assurance Society of the United States, New York, N. Y.

4. "Forest Investment Opportunities and Problems in Canada." David A. Wilson, International Pulp and Paper Company of Canada, Montreal, P. Q., Canada.

TOM GILL. *Toastmaster.*

5. Summary and Evaluation. Ronald I. Beazley, Department of Forestry, Southern Illinois University, Carbondale, Ill.

6. Business meeting.

Division of Forest-Wildlife Management

Tuesday afternoon, November 15

Lansing H. Parker, Chairman
James B. Gilligan, Vice Chairman
Howard A. Miller, Secretary

1. "Coordination — The Practical Approach to Better Forest Game Habitat." Howard A. Miller and R. H. Millar, U. S. Forest Service, Atlanta, Ga.

2. "Use of Herbicides to Improve Browse for Deer." Lauritz Krefting, U. S. Bureau of Sport Fisheries and Wildlife, St. Paul, Minn.

3. "Fishing-for-Fun Program on Trout Streams in Great Smoky Mountains National Park." Robert Lennon, U. S. Bureau of Sport Fisheries and Wildlife, La Crosse, Wis.

4. "Forest Wildlife Relationships in Denmark." Ralph T. King, State University College of Forestry at Syracuse University, Syracuse, N. Y.

5. Business meeting and election of officers.

Division of Forest Management

Wednesday morning, November 16

Thomas B. Glazebrook, Chairman
Frank D. Irving, Jr., Vice Chairman
Wm. J. Bridges, Jr., Secretary
W. T. Doolittle, Program Chairman
Symposium: "Progress in the Technology and Knowledge of Forest Fire Control to Meet the Needs of Forest Management"
Merle S. Lowden, Moderator

1. "The New Air Arm in Forest Fire Suppression." William A. Peter-

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son, U. S. Forest Service, Quincy, Calif.

2. "What Progress Are We Making in Protecting Small Forest Holdings from Fire." Clinton H. Coulter, Florida Forest Service, Tallahassee, Fla.

3. "Progress in the Development of a Unified Forest Fire Danger Rating System." John J. Keetch, U. S. Forest Service, Asheville, N. C.

4. "Forest Fire Research and the Need for Fire Laboratories." J. S. Barrows, U. S. Forest Service, Missoula, Mont., and Charles C. Buck, U. S. Forest Service, Washington, D. C.

5. "Better Quantitative Observations of Atmospheric Phenomena in Going Fires." Vincent J. Schaefer, Research Consultant, Schenectady, N. Y.

Wednesday afternoon, November 16

1. Report of nominating committee and election of officers for 1961.

Theme: "Forest Management Moves Ahead."

2. "Trends in Forest Management Practices on Private Forest Lands in Maryland." Adna R. Bond, Maryland Department of Forests and Parks, Annapolis, Md.

3. "Management Control in Uneven-aged Eastern Forests." Glenn E. Smith, U. S. Forest Service, Upper Darby, Pa.

4. "Multiple-Use Management on National Forest Lands." Lowell O. Woods, U. S. Forest Service, Albuquerque, N. Mex.

5. "Antibiotics Look Good in the Fight to Save Western White Pine from Blister Rust." Homer J. Hartman, U. S. Forest Service, Missoula, Mont.

Discussion. Glenn R. Allison, U. S. Forest Service, Upper Darby, Pa.; William Klomparens, The Upjohn Company, Kalamazoo, Mich.; and Jack Ziffer, Pabst Brewing Company, Milwaukee, Wis.

Division of Range Management

Wednesday morning, November 16

Lowell K. Halls, Chairman
Chas. Terwilliger, Jr., Vice Chairman

1. "Recovery of Herbaceous and Shrubby Vegetation Seven Years After Logging." George A. Garrison, Pacific Northwest Forest and Range Experiment Station, LaGrande, Ore.

2. "The Alpine: Its Place in Multiple-Use Management." Clinton H. Wasser, College of Forestry and Range Management, Colorado State University, Fort Collins, Colo.

3. "Better Use of Native Forage in Southern Forests." Robert E. Williams, Soil Conservation Service, Athens, Ga.

4. "Conversion from Brush to Grass for Multiple Land Use." Merton J. Reed and Jay R. Bentley, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

5. "Livestock-Game Use in White Pine Forests of Idaho." Edwin W. Tisdale, Forest, Wildlife, and Range Experiment Station, University of Idaho, Moscow, Idaho.

Division of Education

Wednesday morning, November 16

William C. Bramble, Chairman
John Carow, Vice Chairman
Allen W. Goodspeed, Secretary

Panel Discussion: "The Proper Role of Extension and Adult Education in Forestry Education"
John Gray, Moderator

1. "State-Level Forestry Responsibilities of a Land-Grant College Extension Service." C. B. Ratchford, Missouri Agricultural Extension Service, Columbia, Mo.

Discussion.

2. "Extension as a Major Phase of a Forestry School Program." R. J. Preston, School of Forestry, North Carolina State College, Raleigh, N. C.

Discussion.

3. "Meeting the Continuing Education Needs of a Forestry School's Executive and Professional Clientele." John W. Barrett, College of Forestry, Syracuse, N. Y.

Discussion.

4. Report of Safety Committee and election of officers.

5. "Selection of Personnel for the U. S. Forest Service." K. M. Daniels, U. S. Forest Service, Washington, D. C.

Discussion.

Division of Watershed Management

Wednesday afternoon, November 16

Jack S. Rothacher, Chairman
Paul J. Zinke, Vice Chairman
Percy B. Rowe, Secretary

Symposium: "Watershed Management's Expanding Action Program."
Harold G. Wilm, Moderator

1. "Pilot Test Watershed Project on the Arizona National Forests." Fred H. Kennedy, U. S. Forest Serv-

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ice, Albuquerque, N. Mex.

2. "Logging Small Watersheds in Western Pennsylvania." James F. Heagy, American Waterworks Service Company, Inc., Philadelphia, Pa.

3. "Forest Plantation Development Influences Streamflow." L. W. Hill, Central States Forest Experiment Station, Columbus, Ohio.

4. "Some Watershed Activities and Results in the Tennessee Valley." K. J. Seigworth, Division of Forestry Relations, Tennessee Valley Authority, Norris, Tenn.

5. "Watershed Management in Action in the Pacific Southwest." W. S. Hopkins, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

Note: No business meeting will be held at the annual meeting unless specifically requested (by at least 10 members). A nominating committee will be named to choose the incoming Secretary. Other offices are filled by automatic advancement of the 1960 Vice Chairman and Secretary.

The Society Dinner

Wednesday evening, November 16

Tom Gill, Toastmaster

1. Presentation of the Sir William Schlich memorial medal, by President Charles A. Connaughton.

2. Presentation of the Gifford Pinchot medal, by President Connaughton.

3. Presentation of the award for achievement in biological research, by President Connaughton.

4. Address.

5. The Howard University Choir.

6. Dancing, 10 p.m. to 1 a.m.

Hotel Reservations

Those planning to attend the meeting are advised to arrive in Washington on Sunday, November 13. The first general session will start at 9:30 a.m., Monday, in the Sheraton-Park Hotel. All scheduled sessions will be held in this hotel.

The Sheraton-Park is on Woodley Road, just west of Connecticut Avenue. The address is 2660 Connecticut Avenue N. W., Washington 8, D. C. The hotel has 1,200 rooms.

There will be no central housing bureau for this meeting. Members should make their own room reservations direct with the hotels of their choice. To enable the hotels to confirm requests, reservations should be received by them not later than October 28. Early reservations are urged.

In all cases, reservation requests should state that the reservation is for the meeting of the Society of American Foresters.

Additional cooperating hotels are listed below, with their rates.

All hotels listed are within the first taxicab fare zone (50 cents). A map of the D. C. Transit System showing streetcar and bus routes will be found on pages 4 and 5 of the Wahington Yellow Pages telephone directory.

Those wishing additional information about hotels and their rates can obtain a complete list from the Washington Convention and Visitors Bureau, 1616 K Street N. W., Washington 6, D. C. Or they can consult the current *Hotel Red Book*, copies of which are available in most hotel lobbies and public libraries.

Hotels and Rates

All rates quoted are for rooms with bath. These are daily rates, subject to the District of Columbia sales tax. If the rate category requested is unavailable, rooms in the next highest category will be assigned.

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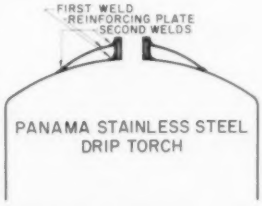

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PROCEEDINGS

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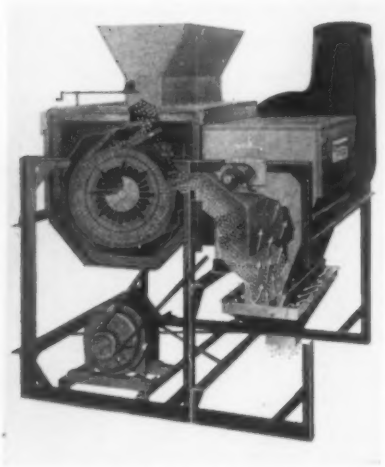

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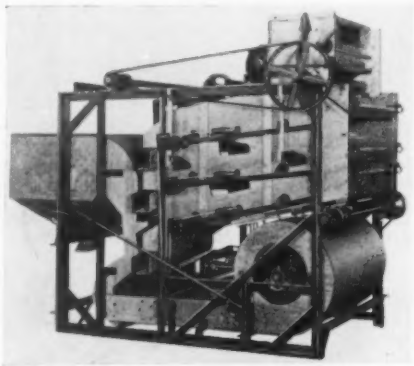

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Burlington Hotel, Vermont Avenue at Thomas Circle, Washington 5, D. C. Single occupancy, $8.95 to $10.95. Double-bed rooms and twin-bed rooms, $13.95 to $15.95. Suites, single occupancy, $12.50; double occupancy, $17.75.

Fairfax Hotel, 2100 Massachusetts Avenue N. W., Washington 8, D. C. Twin-bed rooms, $14. Family suites (two connecting twin-bed rooms for four persons), $16.

Manger Annapolis Hotel, 12th and H Streets N. W., Washington 5, D. C. Single occupancy, $8.50. Double-bed rooms, $11. Twin-bed rooms, $12.

Manger Hamilton Hotel, 14th and K Streets N. W., Washington 5, D. C. Single occupancy, $9. Double-bed rooms, $12. Twin-bed rooms, $13.50.

Manger Hay-Adams, 16th and H Streets N. W., Washington 6, D. C. Single occupancy, $14, $16, and $18. Double-bed rooms, $18 and $20. Twin-bed rooms, $20 and $22.

Mayflower Hotel, Connecticut Avenue at DeSales Street, Washington 6, D. C. Single occupancy, $9 to $20.50. Double-bed rooms $15 to $23.50. Twin-bed rooms, $17 to $25.50.

Shoreham Hotel and Motor Inn, Connecticut Avenue at Calvert Street, Washington 8, D. C. (One block from the Sheraton-Park Hotel.) Single occupancy, $13. Twin-bed rooms, $17. Suites, parlor and twin-bed room, $25; parlor and two bedrooms, $42. The motor inn has rooms each equipped with two double beds, $13 singles and $17 doubles.

Statler Hilton Hotel, 16th and K Streets N. W., Washington 13, D. C. Single occupancy, $7 to $12. Double-bed rooms, $9.50 to $15. Twin-bed rooms, $12 to $18.

Washington Hotel, Pennsylvania Avenue at 15th Street N. W., Washington 4, D. C. Single occupancy, $9, $10, $11.50, $12.50. Double-bed rooms and twin-bed rooms, $14.50, $16, $18. Roll-in-beds, $3.

Willard Hotel, Pennsylvania Avenue at 14th Street N. W., Washington 4, D. C. Single occupancy, $8.50 to $14. Double-bed rooms, $13.50 to $19. Twin-bed rooms, $15 to $21.

MEMBERS of the Northern Rocky Mountain Section meeting at Montana's Swan State Forest.

Foreign University Lecturing and Research Awards

U. S. Government (Fulbright Act) awards for foreign university lecturing and advanced research for 1961-1962 have been announced. Application forms and additional information are obtainable from the Committee on International Exchange of Persons, 2101 Constitution Avenue, Washington 25, D. C.

Awards in forestry and related fields are available in 5 nations: Austria, Finland, Germany, Norway, United Kingdom, and two United Kingdom colonies in Africa.

The closing date for applications is October 1, 1960.

Northern Rocky Mountain Section Holds 49th Annual Meeting

Sixty-five foresters from all parts of Montana met on the Swan State Forest, Saturday, June 4, for a Society of American Foresters business meeting and field trip.

The meeting was the 49th annual meeting of the Northern Rocky Mountain Section of the Society, the first Section organized in the West.

Everett Sanderson, Section chairman, presided at the business meeting, assisted by Richard Marks of Bozeman, vice chairman, and Davis Weistaner of Libby, secretary-treasurer. New chapter chairmen introduced were Russell Hudson of the Libby Chapter, William Pierce of the Missoula Chapter, Robert Lamley of the Flathead Chapter, and William Beaman of the Eastern Montana Chapter.

Montana State Forester Gareth Moon started the program part of the meeting with his report on 50 years of state forestry in the United States and in Montana. Moon emphasized that the Montana state forests were set up and are operated to produce revenue for the state school system.

Problems of the state forests mentioned by the state forester were: putting nonproducing forest lands such as old burns into production, road rights-of-way to state lands, getting overmature stands with poor understory logged and producing young timber, reducing forest damage by wildlife populations, and providing more public recreation facilities.

The field trip conducted by Assistant State Forester Robert Arnold included examination of selective cutting tracts, block clearcutting, old cutover blocks to show reproduction established, and slash disposal and stand improvement work.

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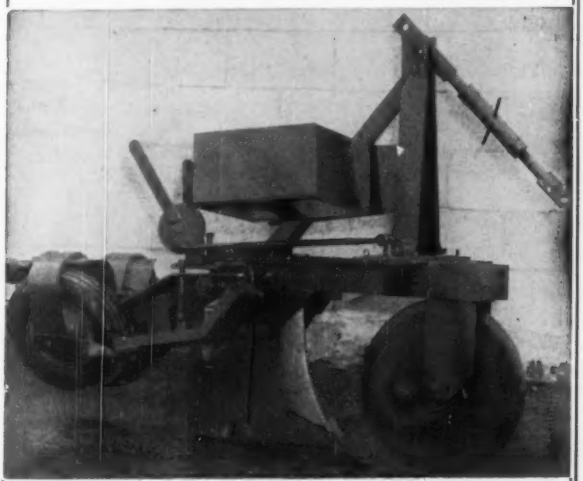

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South Carolina Group Meets

Sixty foresters of South Carolina attended a two-day meeting at the Stumphouse Ranger Headquarters north of Walhalla on June 3 and at Clemson College on June 4.

Highlight of the Friday afternoon session was a tour of the General Pickens Ranger District. Donald Thornton, district ranger with the U. S. Forest Service, arranged and conducted the tour to give foresters an opportunity to observe forest management in the mountain area. The evening was devoted to swimming, boating, and fishing at the Oconee State Park.

On tour of the Clemson College Department of Forestry Saturday morning, foresters observed research work in progress. Included on the tour were prescription planting, hardwood management, and nursery density studies. The tour was headed by Dr. K. Lehotsky, head of Clemson's Department of Forestry.

Arrangements for this summer meeting of the Appalachian Section, Society of American Foresters, were made by S. A. Marbut, Clemson extension forester.

Notice: American Foresters Visiting the U.K.

American foresters who expect to visit the United Kingdom during the coming academic year are invited to notify M. E. Ball, Secretary of the Forestry Society, Forestry Department, University College of North Wales, Bangor, Caerns., North Wales, U.K.

Mr. Ball is arranging a series of evening lectures for the Forestry Society during the coming season, and would like to have an American forester give one of the lectures.

Coming Events

Northeastern Forest Tree Improvement Conference

The eighth NEFTIC meetings will be held on the campus of Yale University in New Haven, Conn., August 18-19. Dormitory facilities of the University will be available for NEF TIC members.

Allegheny Section

The Allegheny Section will hold a meeting at the Hotel Casey, Scranton, Pa., August 18-20, 1960.

Upper Mississippi Valley Section

The summer meeting of the Upper Mississippi Valley Section will be held in Duluth, Minn., August 18-20, 1960.

Society of American Foresters

The sixtieth anniversary meeting of the Society of American Foresters will be held at the Sheraton-Park Hotel, Washington, D. C., November 13-16, 1960.

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Lowther Heavy duty tree planters insure deep penetration and straight root systems.

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Central States Section

The meeting of the Central States Section will be held at Franklin Park, Ill., a (west) suburb of Chicago, on October 13-14, 1960. The theme is Recreation.

Canadian Institute of Forestry

The 1960 annual meeting of the Canadian Institute of Forestry will be held at the Chateau Frontenac, Quebec City, Canada, October 24-27, 1960.

Revision of Bases for Accrediting Professional Forestry Education

The Society's Committee for the Advancement of Forestry Education has revised the "Bases for Accrediting Professional Forestry Education." The revised Bases, approved by the Council at its November 18, 1959 meeting in San Francisco, have been printed and are available from the Executive Secretary. Copies have been sent to all U. S. forestry schools.

All accredited forestry education programs, not examined in recent years by the SAF in cooperation with regional college associations, will be examined by July 1, 1961 to determine their conformance to the revised minimum standards. The revised Bases will be applied to all institutions requesting accreditation examination of professional forestry education programs.

The Society of American Foresters is listed by and cooperates with the National Commission on Accrediting, being the only professional society thus listed in the renewable natural

Year 'round forester. *Having 305 horsepower overhead is generally accepted as essential during fire season, but Hiller 12 E's do big work in forest management all year long.*

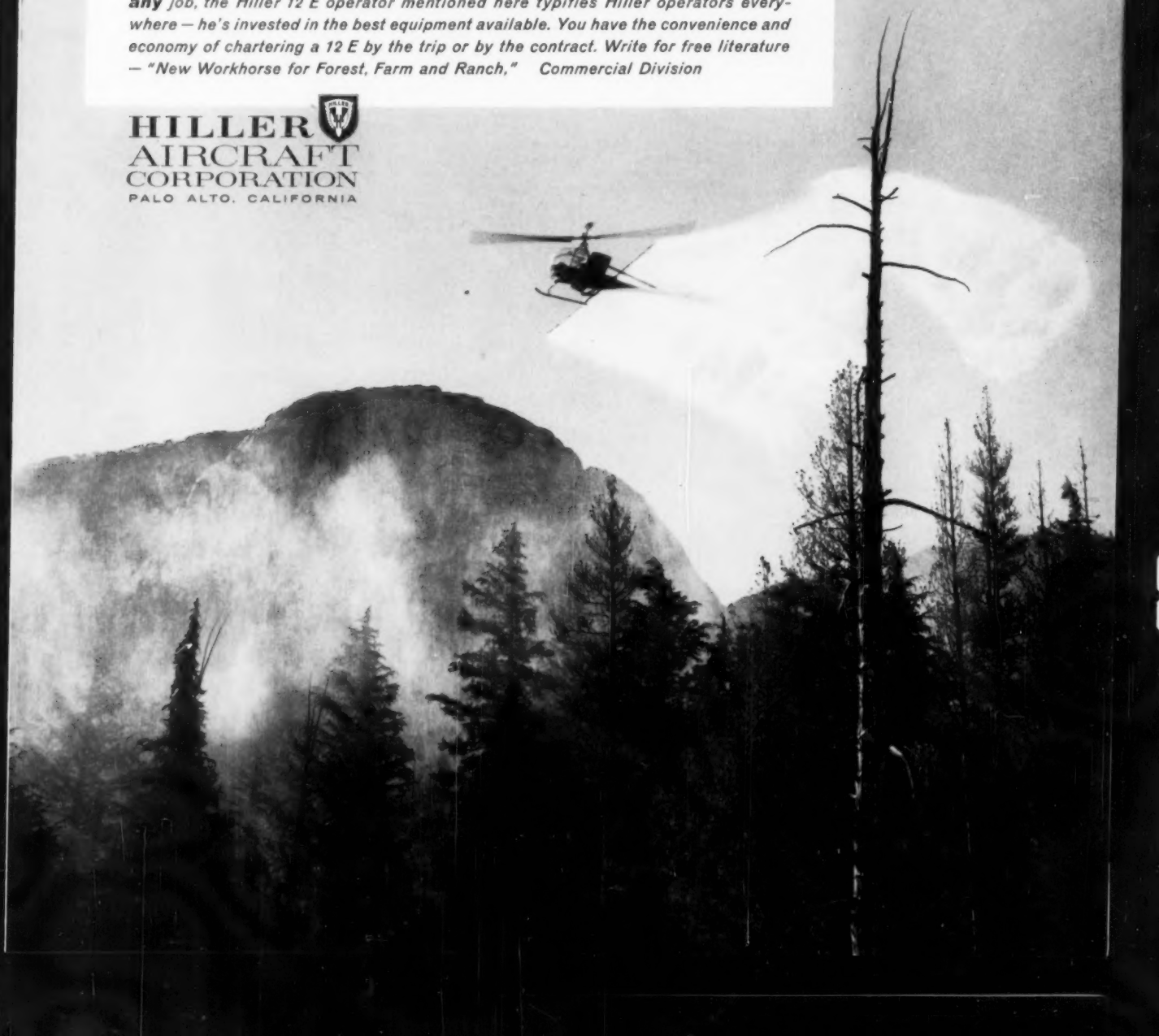
EXAMPLE: *Spraying the lodgepole pine forests in Yosemite National Park and at two mile high Tuolumne Meadows to fight the insidious needle miner. After five years' research, National Park Service officials contracted for* ***helicopter treetop spraying*** *according to U. S. Forest Service entomologists' prescription — 2 pounds Malathion in 20 gallons diesel oil per acre.*

Two 305 hp Hiller 12 E's, operated by WhirlWide Helicopters, Fresno, Calif., handled the entire spray contract from "loading docks" above the 8,500 foot level. Within seconds after the first ship lifted off a dock for the 10,000 foot level with 80 gallons of Malathion solution, the second 12 E would land at the same dock for loading, refueling, safety and operating checks.

Average ground time for loading was 60 seconds! Air speeds on spraying runs, 55 mph. Because prevailing winds halted operations at 9:30 A.M., this pace continued from 6 A.M. — totaling 30 plus trips per ship, per day!

Whatever the season and whatever your forest management project, for service on ***any*** *job, the Hiller 12 E operator mentioned here typifies Hiller operators everywhere — he's invested in the best equipment available. You have the convenience and economy of chartering a 12 E by the trip or by the contract. Write for free literature — "New Workhorse for Forest, Farm and Ranch," Commercial Division*

HILLER AIRCRAFT CORPORATION
PALO ALTO, CALIFORNIA



resources area. It cooperates with all regional college and university associations when periodic accreditation examinations are made of institutions containing professional forestry programs.

The revised Bases place added emphasis on the nature and strength of the parent institution in which the professional forestry education program is located. The reason for such added emphasis on the parent institution is indicated in the following quote from the Bases:

> It is the belief of the Committee for the Advancement of Forestry Education that professional education in forestry can best be accomplished and will reach its highest development in Departments, Divisions, Schools, or Colleges of Forestry located in, or closely associated with, institutions of true university caliber. Institutions of this type possess strong degree-granting departments in the basic sciences and in the broad cultural subjects, as well as professional education programs in several fields accredited by their respective professional organizations. In such institutions professional education in forestry is not likely to be entered into lightly.

The minimum staff size has been increased by one. The growing complexity of forestry, the rapid development of new areas, and the need to insure that even the minimum-size staff has some time for professional development and research are the reasons for this change. The new minimum staff requirement is defined in the following quote from the Bases:

> A faculty of at least six men in the Department, Division, School, or College of Forestry, educated in forestry and teaching silviculture, forest protection, forest management, forest economics, forest utilization, and such closely related areas as, for example, watershed management, range management and forest recreation; plus the equivalent of at least one qualified man teaching courses within the forestry curriculum and designed specifically for foresters; plus such additional staff as may be required to teach basic courses in biology, engineering, etc., when such courses are taught within the Department, Division, School, or College of Forestry.

The forestry-staff salary schedule of the Bases has been revised to reflect 1960 salary levels. This revision is based on information gathered from the accredited schools and encompasses the considerable existing range. Because of the keen competition for competent staff members, the salary schedules of forestry schools have become increasingly important in holding and attracting qualified individuals at specific institutions as well as in attracting well-trained and experienced men to the forestry education field. Improving the salary schedules in the field of professional forestry education should be the concern of all professional foresters.

While the above changes are the more important, many other changes have been made in the Bases to update them and more nearly reflect 1960 conditions. Forestry education has changed and will continue to change. The Society's minimum standards attempt to recognize these changes. They are admittedly a series of compromises and subject to criticism. They attempt to define what the Society of American Foresters considers minimum standards for professional forestry education. They do not attempt to define or outline the requirements of strong professional forestry education programs. Conformance to the minimum standards thus should be considered as but the first step in any institution's attempt to develop strong professional forestry education. Institutions unable or unwilling to consider development beyond the minimum standards should be discouraged from entering this important professional education area.

The Committee's objective and function are well described by its name. Its concern is not with the number of professional forestry education programs but with their quality. It is willing and anxious to assist interested institutions achieve accreditation and further develop their professional forestry education. It is convinced that only through the maintenance of high standards in professional forestry education can the Society of American Foresters maintain its stature among professional societies. The Committee

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Photographed on an International Paper tree farm by William Vandivert.

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International Paper has long recognized that well-managed and protected forests provide refuge and food for a wide variety of North America's game species as well as a continuous crop of trees.

We also recognize that, to many Americans, the nation's forest acres represent the opportunity to enjoy recreational and spiritual values found only in Nature.

Each year, thousands of our neighbors visit our tree farms to hunt and fish, to picnic, or simply to enjoy the woodlands' peace and quiet.

It is our policy always to manage the woodlands over which we are custodians so as to provide the maximum production of our forest products, to improve these lands as watersheds and wildlife habitat, and to offer the widest opportunity for the enjoyment of these resources.

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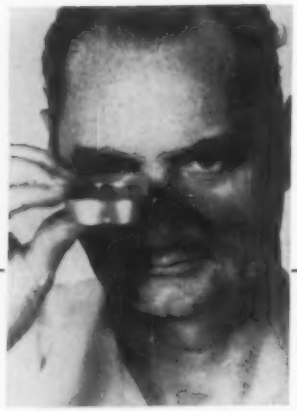

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solicits the support of all professional foresters in its objective and function of continually advancing and improving professional forestry education.

*Committee for the **Advancement** of Forestry Education*

S. G. Fontanna
C. M. Kaufman
W. F. McCulloch
Ernest Wohletz
F. H. Kaufert, *Chairman*

Visiting Scientists Program in Forestry to Start

The National Science Foundation, Washington, D. C., has made a grant of $15,730 to the Society of American Foresters for the purpose of conducting a Visiting Scientists Program in Forestry for a period of one year, beginning July 1, 1960.

The Foundation administers several programs for education in the sciences. One of these is the Visiting Scientists Program, described by NSF as follows:

"This program facilitates visits by distinguished scientists to colleges and small universities for periods of several days to give lectures, to conduct classes and seminars if desired, and to meet students, faculty members, and administrative officers, on an informal basis in order to stimulate interest in science. The program is administered through grants to the appropriate professional scientific societies."

As outlined by NSF, the objectives of the program in forestry are:

1. To strengthen undergraduate and graduate forestry work in colleges.
2. To provide staff and students with opportunity for additional contacts with productive and creative scientists.
3. To aid in the motivation of able college students toward careers in forestry and teaching in the field of forestry.

The SAF Council has authorized a small committee to administer the program: George A. Garratt as chairman and adviser, and Henry Clepper as director.

Any institution of higher learning that offers curricula or courses in forestry will be eligible to participate in the program. No costs or expenses to the institution are involved since the NSF grant will reimburse the visiting scientists for travel expenses together with an honorarium while on-campus visits.

Additional information about the program will be provided later to all

World Directory of Forestry Schools

Published by the Society of American Foresters in collaboration with the Food and Agriculture Organization of the United Nations, this 300-page book gives authentic information on 140 schools throughout the world that provide professional education in forestry.

In addition to the name and address of each forestry school, and the university or college with which it is affiliated, specific data for every school include:

Titles or degrees awarded.
Types of curricula, and plan of studies.
Number of teachers and research workers.
General types of forests studied in the field.

Average number of students graduated annually.

Entrance qualifications for national and foreign students.

Possibilities for practical work during vacations and money-earning opportunities.

Approximate cost of tuition, field trips, books and equipment, housing and subsistence.

Facilities, including laboratories, libraries, working collections, and field installations.

Number of foreign students acceptable, application procedure, scholarships available, housing facilities, social and cultural opportunities.

This book is the most recent and only complete summary of information on the world's forestry schools.

Copies available for $5.50 each (U. S. dollars), postpaid. Send remittance with order to

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We are pleased that your official trip will include a visit to some of these facilities. It is our hope that the tours will give you a better understanding of the Pacific Northwest forest products industry.

As background information, our timberlands include 13 certified tree farms on which timber is managed as a continuous crop. Dominant tree species are Douglas fir, western hemlock, western red cedar, sitka spruce, ponderosa pine, white fir and sugar pine. Manufacturing facilities include lumber, plywood, pulp, paperboard, pulping chemicals, hardboard, particle board, kraft overlaid veneer, wood fiber and bark products. These are located on 12 integrated millsites. Also nearby are our forestry, pulp and wood products research centers.

If you would like to learn more about our American forest products industry, two booklets are available, *Forest Products from Tree Farm to You* and *Tree Farming in the Pacific Northwest*. Write us at Box A, Tacoma, Washington, for your copies.

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the institutions having forestry courses, together with a list of forester-scientists who will participate. Meanwhile, a list is being compiled of at least 12 to 15 names of participants who will be available for at least one, and preferably, two-week assignments during the period October 1960 through May 1961.

Edmund C. Melcher (1894-1960)

Edmund C. Melcher, 65, of Bingham, Maine, in charge of the Woodlands Department for S. D. Warren Company, died April 2, 1960.

Born in Westbrook, Maine, November 11, 1894, Mr. Melcher was educated at the University of Maine.

Following service as a second lieutenant in the Field Artillery in World War I, he joined the S. D. Warren Company in 1921 as assistant forester, and in 1928 was made forester. As manager of the Woodlands Department, his career included the practice of silviculture on the company lands, and the application of good logging operations for pulpwood production.

He was a Member of the Society of American Foresters, and a director of the American Pulpwood Association.

R. Kent Beattie (1875-1960)

Rolla Kent Beattie, 85, former botanist and forest pathologist in the U.S. Department of Agriculture, died June 2 in a nursing home in Bethesda, Md.

Born January 14, 1875, in Ashland, Ohio, he was graduated from the University of Nebraska in 1896 with the B.Sc. degree and in 1898 with the A. M. degree.

Beginning his career as a science teacher, he became an instructor in botany at Washington State College in 1899, becoming head of the department in 1905. He entered the old Bureau of Plant Industry of the U. S. Department of Agriculture in 1912. Thereafter his distinguished career as a forest pathologist was spent in the department.

For years he was in charge of research and control of major forest diseases of foreign origin. He headed the department's extensive efforts in the Orient to find and develop an exotic chestnut species to replace the native chestnut killed by the bark disease. He also worked on Dutch elm disease, and was a leading authority on imported forest nursery diseases.

As pathologist in charge of foreign plant quarantines for the Federal Horticultural Board, he organized this work and directed its enforcement during the period 1919-1927. His writings on plant pathological subjects were extensive.

Mr. Beattie retired from the Department of Agriculture in 1945 after some thirty-three years of government service.

Research Proposals Deadline

The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of basic research proposals in the Life Sciences is September 15, 1960. Proposals received prior to that date will be reviewed at the fall meetings of the Foundation's advisory panels and disposition will be made approximately four months following the closing date. Proposals received after the September 15, 1960, closing date will be reviewed following the spring closing date of January 15, 1961.

Inquiries should be addressed to the National Science Foundation, Washington 25, D. C.

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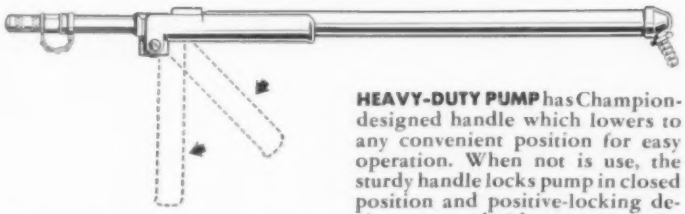

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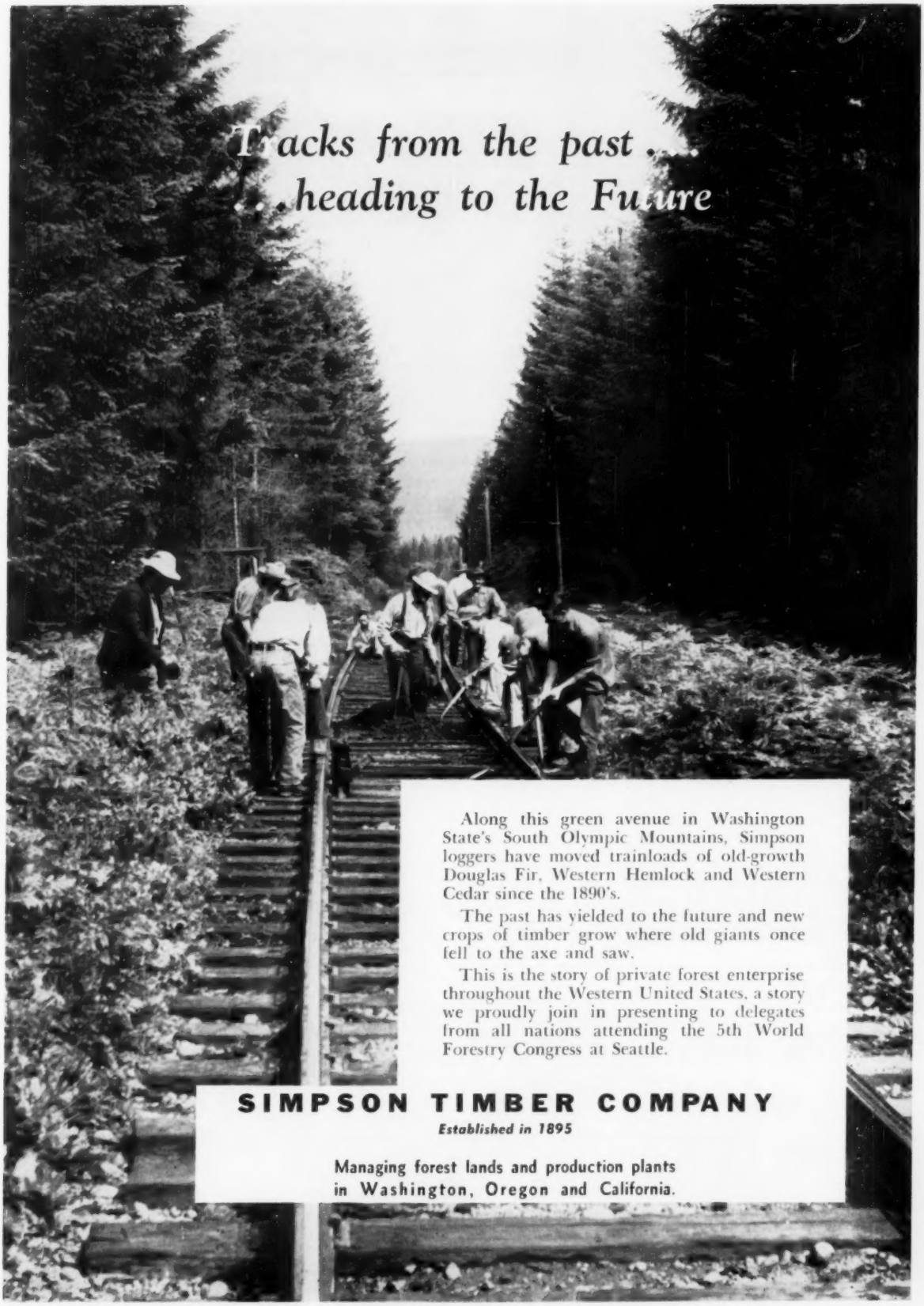

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Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of June are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of August 31, 1960.

Communications from the voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

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Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Hawk, R. E.

Junior Grade

Students Eligible for Automatic Advancement

PENNSYLVANIA STATE UNIVERSITY

Archibald, W. M.
Barnard, J. E.
Berkey, D. L.
Bowlin, H. L.
Brenneman, B. B.
Epp, G. R.
Forney, R. T.
Fosnocht, W. A.
George, T. A.
Grundhofer, R. E.
Heroux, J. B.
Hill, T. M.
Hirt, R. L.
Hutchison, B. A.
Johnson, S. B.
Jones, R. A.
Kaufman, R. L.
Lewis, E.
Lindsey, K. D.
McDonald, F. W.
Moore, T. R.
Nordberg, J. A.
Nuss, M. E.
Nutter, W. L.
Perry, R. J.
Pitzer, H. C.
Rappaport, A. N.
Rupp, C. M.
Singer, J. R.
Smith, G. T.
Stauffer, W. K.
Voytas, F. J.
Warren, W. B.

WEST VIRGINIA UNIVERSITY

Antill, R. G.
Brown, E. B.
Conn, C. K.
Dickens, B. H.
Ginn, C. R.
Gnegy, D. C.
Gregory, H. D.
Griffin, E. L.
Mace, A. C.
Meadows, M. B.
Price, J. D.
Rowan, G. S.
Ruddle, M. D.
Stalnaker, C. B.
Strawn, G. D.
Strickland, J. R.
Thomas, C. L.
Yeager, J. N.

Appalachian Section

Junior Grade

Students Eligible for Automatic Advancement

DUKE UNIVERSITY

Beamer, H. L.
Beck, D. E.
Bodie, W. C.
Davis, M. L.
Dutrow, G. F.
French, T. B.
Fritz, G. P.
Harrison, W. L.
Judy, C. P.
Morgan, R. L.
Moyers, G. B.
Rogers, J. D.
Singer, S. R.
Stone, J. M.
Swisher, K. J.
Torrey, W. F.
Vaughn, J. E.
Will, N. P.

NORTH CAROLINA STATE COLLEGE

Banner, W. T.
Barnard, P. W.
Bass, J. L.
Batten, V. F.
Belt, G. H.
Bost, R. M.
Brake, R. F.
Bramlett, D. L.
Breeman, L. G.
Brinkley, C. W.
Carrigan, W. C.
Cawthorne, W. G.
Collier, T. W.
Doggett, C. A.
Eliades, G. K.
Eskridge, C. D.
Gaines, G. L.
Hampton, G.
Hasenoehrl, F. S.
Henderson, K. D.
Hilbourn, T. O.
Howell, J. W.
Hunter, T. G.
Leach, R. E.
Mattocks, R. L.
McMinn, J. W.
Moore, C. F.
O'Quinn, C. N.
Potter, C. L.
Precythe, H. W.
Pridgen, J. P.
Roberds, J. H.
Rose, P. C.
Scott, J. M.
Selden, C. W.
Sherwood, R. W.
Smathers, S. T.
Sutton, D. A.
Taylor, L. R.
Vinson, J. B.
Wallinger, R. S.

Member Grade

Martin, C. E., Asst. Dist. Forester, West Va. Pulp & Paper, Cross, S. C. Duke Univ., BSF, 1953, MF, 1954 (Junior 1954).

Affiliate Grade

Shearin, A. T., Asst. Forester, Clemson College, Clemson, S. C.

Central Rocky Mountain Section

Junior Grade

Blacker, R. K., Forest Supv., USFS, Cody, Wyo. Ore. State, BSF, 1939.

Mayberry, G. D., Dist. Ranger, USFS, Leadville, Colo. Iowa State, BSF, 1952.

Van, S. H., Staff Asst., USFS, Laramie, Wyo. (Reinstatement).

Students Eligible for Automatic Advancement

COLORADO STATE UNIVERSITY

Bailey, E. F.
Brown, G. W.
Cazier, J. R.
Genre, J. D.
Knudson, D. M.
Outslay, G.
Shain, W. E.

Member Grade

Boubelik, C. F., 2311 Pontiac, Denver, Colo. (Junior 1953).

Knutson, K. K., Forester, USFS, Steamboat Springs, Colo. (Reinstatement).

Central States Section

Junior Grade

Students Eligible for Automatic Advancement

PURDUE UNIVERSITY

Barratt, J. W.
Beineke, W. F.
Cleaver, R. L.
Coppess, B. O.
Dierking, D. V.
Flack, J. R.
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Petty, P. E.
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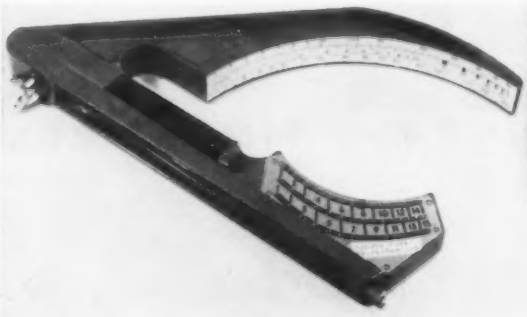

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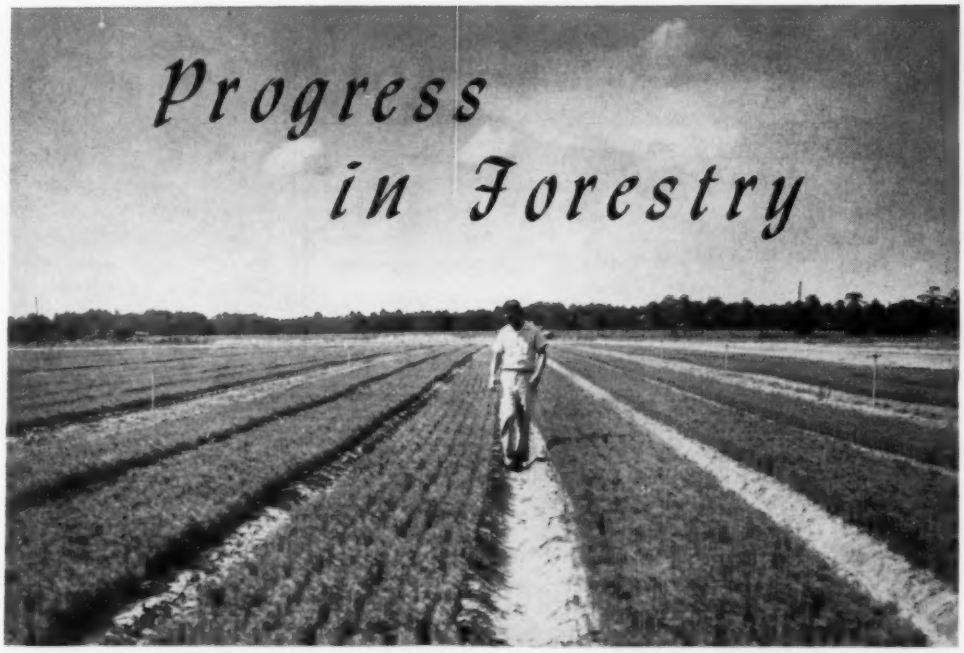

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Columbia River Section

Student Grade

OREGON STATE COLLEGE

Ames, G. L. — Judge, L. T.
Bryant, D. O. — Judson, A.
Carter, M. I. — Oliver, E. K.
Jorgensen, Q. — Sisson, V. E.

Junior Grade

Hildenbrand, H. A., Logging Supt., U. S. Plywood Corp., Roseburg, Ore. (Affiliate 1953).

Rudy, F. D., Forester, USFS, Grants Pass, Ore. Univ. Minn., BSF, 1957.

Students Eligible for Automatic Advancement

OREGON STATE COLLEGE

Armstrong, W. S. — Meyer, A.
Arundell, D. L. — Mohr, D. D.
Aulerich, D. E. — Murray, M. D.
Axon, N. A. — Olsen, R. J.
Bellamy, R. B. — Olson, F. W.
Carlson, J. P. — Pederson, R. E.
Clark, H. L. — Peterson, R. A.
Clark, M. N. — Ramsing, K. D.
Crowl, J. D. — Rondeau, R. A.
DeRidder, C. G. — Schultheis, W. A.
Farr, G. H. — Scott, B. G.
Hanson, R. P. — Smith, W. H.
Harvey, W. L. — Sparks, J. G.
Henning, C. C. — Stone, D. R.
Iliinsky, N. P. — Sykes, G. L.
Larsen, R. S. — Thingvall, O. A. J.
Lyche, W. D. — Ullmann, D. T.
MacWilliams, J. D. — Van Dyke, D. W.
Mann, K. D. — Waitt, R. E.
McCall, B. R. — Warner, W. R.
Menand, J. E. — Weisgarber, J. F.
Meusch, J. D. — Withrow, R. N.
Wood, D. A.

Member Grade

Taylor, R. E., Asst. Dist. Ranger, USFS, Ashland, Ore. Univ. Idaho, BSF, 1950 (Junior 1954).

Affiliate Grade

McLean, F. G., Land Adm. Asst., Weyerhaeuser Co., Castle Rock, Wash.

Redding, C. L., Forester, USFS, Idleyld Park, Ore.

Gulf States Section

Student Grade

LOUISIANA STATE UNIVERSITY

Monk, D. L.

Junior Grade

Ham, B. G., Forester, Columbia Carbon Co., Fairbanks, La. La. Poly., BSF, 1954.

Students Eligible for Automatic Advancement

LOUISIANA POLYTECHNIC INSTITUTE

Allen, R. S. — Hunter, A. G.
Bays, R. M. — Lora, H.
Bergmann, E. H. — Moon, D. R.
Campbell, W. G. — Russell, R. L.
Eubanks, C. L. — Searles, T. D.
Hall, A. — Vail, W. K.
Harrison, T. H. — Webb, F. W.

LOUISIANA STATE UNIVERSITY

Bankston, J. R. — Jones, H. L.
Bedell, A. U. — Kile, G. W.
Callahan, T. A. — Miley, L. E.

Echols, H. W. Palmer, W. J.
Felps, J. V. Smith, A. B.
Johnson, G. A. Winters, C. S.

Member Grade

Moyle, R. C., Dist. Ranger, USFS, Hamphill, Texas. Pa. State, BSF, 1950 (Junior 1954).
Wright, H. R., Forester, USFS, Lufkin, Texas (Reinstatement).

Affiliate Grade

Webb, B. C., Forester, International Paper Co., Kosciusko, Miss.
Zwick, D., Forester, International Paper Co., Minden, La.

Inland Empire Section

Junior Grade

Students Eligible for Automatic Advancement

UNIVERSITY OF IDAHO

Bartlett, K. H. Hopin, W. W.
Bledsoe, J. B. Johnson, R. C.
DeMeyer, J. R. Kip, H. W.
Dubbels, L. G. Kisska, L.
Ewing, W. R. McElwain, K. F.
Garrett, A. E. O'Donnell, J. F.
Hamner, B. H. Sonnichson, R. C.
Hauxwell, D. L. Underwood, J. F.
Wisdom, H. W.

Intermountain Section

Student Grade

UTAH STATE UNIVERSITY

Lewis, W. E.

Junior Grade

Students Eligible for Automatic Advancement

UTAH STATE UNIVERSITY

Arnold, C. T. Howell, D. E.
Bailey, S. J. Ireland, W. E.
Boyles, J. S. Livingston, G. K.
Chidsey, P. McCleese, W. L.
Draper, J. A. Owen, R. K.
Ellison, R. A. Quinn, J. T.
Gee, W. P. Randall, R. M.
Goon, J. T. Schwartzrock, H. T.
Trowbridge, J. E.

Affiliate Grade

Schmeling, W. A., Asst. Ranger, USFS, Fairfield, Idaho.

New England Section

Student Grade

UNIVERSITY OF MAINE

Demo, M. W. Platt, B. H.

UNIVERSITY OF MASSACHUSETTS

Davidson, W. H.

Junior Grade

Students Eligible for Automatic Advancement

UNIVERSITY OF MAINE

Carter, F. E. Jackson, L. W.
Clement, D. B. Moore, J. P.
Collins, B. C. Morrill, A. A.
Cotreau, P. A. Probert, J. B.
Gates, B. L. Rose, K. H.
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Gordon, A. F. Shumway, R. S.
Hall, L. R. Stuart, G. W.
Holmsen, R. H. Van Sickler, R. T.

UNIVERSITY OF MASSACHUSETTS

Franz, G. J. Nason, M. W.
Rose, W. E.

UNIVERSITY OF NEW HAMPSHIRE

Eaton, J. S. Kinder, R. G.
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Kent, C. A. Noyes, D. R.
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YALE UNIVERSITY

Bricken, C. A. Lantz, C. W.
Daly, E. F. Nelson, K. G.
Ellis, T. H. Slade, R. G.
Huberth, P. M. Stairs, G. R.
Winkworth, A. V.

Member Grade

Plumb, A. W., Resident Forester, New England Forestry Foundation, Inc., Boston, Mass. (Affiliate 1951, Junior 1955).

New York Section

Junior Grade

Students Eligible for Automatic Advancement

STATE UNIVERSITY OF NEW YORK

Bergoffen, G. S. Laufer, K. S.
Butt, J. P. MacPherson, R. J.
Canham, H. O. Malchow, R. H.
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Dailey, F. D. Momberger, G. L.
Defendorf, P. E. Nelson, D. H.
Foster, C. A. Sharpe, D. M.
Hutchinson, R. W. Shirley, F. C.
Landino, J. L. Torgersen, T. R.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Benedict, R. M. Hooper, J. F.
Unsoeld, G. S.

Junior Grade

Students Eligible for Automatic Advancement

UNIVERSITY OF CALIFORNIA

Austin, K. A. Cook, S. R.
Barrette, B. R. Lanier, G. N.
Bentley, W. R. Leonard, R. L.
Bicho, J. G. Rennie, R. L.
Bradley, S. P. Sharp, F. W.
Collins, D. R. Smith, J. C.
Vasey, R. B.

Member Grade

Flynn, R. E., Fire Control Staff Office USFS, Redding, Calif. Ore. State, BSF, 1948 (Junior 1956).
Rogers, R. L., Asst. Forester, Simpson Redwood Co., Klamath, Calif. Mont. State, BSF, 1955 (Junior 1955).
Rotto, M. A., Area Procurement Mgr.,

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Koppers Co., Inc., Oroville, Calif. Univ. Calif., BSF, 1954 (Junior 1955).

Scharf, R. M., Asst. Dist. Ranger, USFS, Upper Lake, Calif. Univ. Mich., BSF, 1956 (Junior 1956).

Northern Rocky Mountain Section

Junior Grade

Brown, C. W., Forester, USFS, Missoula, Mont. Univ. Idaho, BSF, 1938.

Royer, W. L., Owner, Custom Sawmilling, Kalispell, Mont. Univ. Minn., BSF, 1930.

Students Eligible for Automatic Advancement

MONTANA STATE UNIVERSITY

Brown, G. G.	McMahon, J. P.
Christianson, R. D.	Nonnenmacher, K.
Colgan, D. L.	Noyd, L. C.
De Bruin, E. H.	Patterson, J. B.
Emerson, J. C.	Payne, J. A.
Gorsh, J. W.	Poncin, D. E.
Haiges, M. L.	Quinn, H. G.
Hoffman, J. O.	Ruff, P. H.
Johnson, P. S.	Smith, C. E.
Joyce, A. T.	Svenson, R. K.
Keppner, A. P.	Taylor, A. R.
Kimery, P. H.	Threlkeld, D. L.
Landgraf, L. K.	Thullen, R. J.
Manz, J. W.	Traylor, R. E.
McBride, J. R.	Troedsson, N. A.
McGrath, W. T.	Whitesitt, D. D.

Affiliate Grade

Woodward, R. E., Fire Control Officer, USDA, Libby, Mont.

Ozark Section

Student Grade

UNIVERSITY OF MISSOURI

Wilkins, L. F.

Junior Grade

Levins, R. R., Block Forester, Fordyce Lumber Co., Fordyce, Ark. (Affiliate 1957).

Students Eligible for Automatic Advancement

UNIVERSITY OF MISSOURI

Aubin, F. G.	Kilbury, R. R.
Barney, J. M.	Meredith, T. H.
Bergman, F. W.	Nelson, W. J.
Cockrel, R. G.	Nielsen, R. R.
Culbertson, D. H.	Parnell, R. G.
Dietzel, W. D.	Percival, D. E.
Ewing, F. E.	Rast, E. D.
Gaines, V. H.	Rogge, F. C.
Hurlbut, D. D.	Sanders, C. C.
Jacobs, B. J.	Schweer, W. R.
Joiner, G. W.	Shelby, W. E.

Taylor, L. A.

Member Grade

Arnold, W. D., Secy., Chillicothe Lumber Co., Inc., Chillicothe, Mo. Iowa State, BSF, 1952 (Junior 1955).

Hoover, C. C., Sales & Production Mgr., Forest Products, Inc., Cassville, Mo. Iowa State, BSF, 1942 (Junior 1956).

Affiliate Grade

Williams, F. J., 403 So. Main St., Monticello, Ark.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Beckman, K. M.	Mathis, J. L.
Cain, A. B.	Merrill, S. B.
Ensley, B. J.	Mohlman, D. T.
Fagerness, G. A.	Moore, L. C.
Heimbigner, C. L.	Olson, R. E.
Jacobson, B. G.	Ramm, A. S.

Junior Grade

Millpointer, R. F., Forester, M & D Timber Co., Port Angeles, Wash. Univ. Wash., BSF, 1955.

Students Eligible for Automatic Advancement

UNIVERSITY OF WASHINGTON

Anderson, W. L.	Hulse, R. S.
Boone, W. L.	Johnson, B. L.
Bourgault, P. A.	MacDonald, D. J.
Carpenter, W. V.	McKay, R. M.
Chalberg, V. A.	Prichard, J. A.
Coffelt, A. E.	Reimer, R. D.
Corbin, R. L.	Robinson, A. M.
Davis, J. M.	Ronholt, D. O.
Dugas, F. A.	Ryckman, J. D.
Green, O. N.	Selle, P. F.
Herlocker, D. J.	Swanson, D. L.
Howry, R. S.	Swier, D. W.

Tolstrup, E. M.

Southeastern Section

Student Grade

AUBURN UNIVERSITY

Dukes, J. A.

UNIVERSITY OF GEORGIA

Bennette, J. W.	Gilbert, C. I.
Fussell, J. S.	Gross, O. S.

Junior Grade

Students Eligible for Automatic Advancement

AUBURN UNIVERSITY

Andress, W. G.	Leonard, R. E.
Aylin, C. E.	Malone, W. B.
Baggett, W. S.	Owens, R. O.
Boyd, W. H.	Price, R. F.
Broughton, B. C.	Shepherd, J. N.
Brown, J. E.	Simms, H. M.
Clements, M. L.	Sims, J. W.
Hunt, W. C.	Turner, A. B.
Kirkby, A. H.	Utter, O. W.

Warr, W. W.

UNIVERSITY OF FLORIDA

Bollinger, R. W.	McKeithen, A. B.
Cochran, J. R.	Nelson, B. W.
DeRolf, W. H.	Snedaker, S. C.
Eckford, J. W.	Wilder, P. D.
Garst, C.	Williams, G. T.

UNIVERSITY OF GEORGIA

Brack, C. E.	Landrith, H. W.
Brackin, T. C.	Melton, T. K.
Brantley, F. D.	Metcalf, G. E.
Bryan, P. W.	Moore, J. F.

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Kendrick, H. C.
Ketchie, N. L.
Nash, F. L.
Nunn, R. C.
Oettmeier, W. M.
Paris, C. D.
Patterson, B. E.
Paul, J. T.
Paulk, R. C.
Peeler, H. H.
Pope, G. E.
Purdom, D. T.
Reese, R. W.
Roush, D. A.
Russell, R. D.
Sherrod, J. C.
Turner, R. M.
West, A. W.
White, J. F.
Wilson, C. T.

Southern California Section

Junior Grade

Tucker, D. M., Forester, USFS, San Bernardino, Calif. (Reinstatement).

Southwestern Section

Junior Grade

Miller, J. R., Asst. Dist. Ranger, USFS, Questa, N. Mex. Colo. State, BSF, 1958.

Upper Mississippi Valley Section

Student Grade

UNIVERSITY OF MINNESOTA

Erickson, G. A.

Junior Grade

Gorence, J., Staff Forester, Dept. of Cons., Grand Rapids, Minn. (Affiliate 1951).

Green, A. W., Research Forester, Amana Experimental Forest, Amana, Iowa (Reinstatement).

Kallio, E., Forester, Iron Range Resources & Rehab., Hibbing, Minn. (Reinstatement).

Students Eligible for Automatic Advancement

IOWA STATE UNIVERSITY

Anderson, G. E.
Anderson, P. O.
Bulman, J. S.
Christopher, P. A.
Covault, J. D.
Ficken, L. D.
Halverson, H. G.
Hanks, L. F.
Jensen, K. F.
Joens, R. L.
Madsen, A. R.
Pfister, R. D.
Schelhaas, J. A.

UNIVERSITY OF MINNESOTA

Anderson, K. W.
Becker, G. C.
Benson, M. K.
Brown, J. K.
Cottrell, H. C.
Eckstein, C. W.
Edvenson, D. M.
Fisher, H. E.
Frissell, S. S.
Grafstrom, M. D.
Haissig, B. E.
Halverson, S. D.
Hauser, M. S.
Hayden, M. S.
Hinds, L. R. W.
Jensen, G. L.
Kiefer, W. D.
Koepp, F. W.
Larson, R. G.
Lee, N. R.
Lindell, G. R.
Linne, D. W.
Lukes, B. M.
Mohn, C. A.
Murphy, G. E.
Nelson, J. A.
Pearson, G. C.
Prigge, P. E.
Probasco, J. M.
Puetz, C. D.
Rademacher, R. J.
Sober, T.
Stout, B. E.
Sudheimer, L. C.
Swanson, W. A.
Therrien, E. N.

Washington Section

Affiliate Grade

Hall, J. F., Forester, Albert G. Hall & Associates, Washington, D. C.

Wisconsin-Michigan Section

Student Grade

MICHIGAN COLLEGE OF MINING & TECHNOLOGY

Preston, D. R.

Junior Grade

Bussey, J. A., Soil Conservationist, U. S. Soil Cons. Service, Phillips, Wis. (Reinstatement).

Wallace, R. P., Area Forester, Bureau of Indian Affairs, Ashland, Wis., Iowa State, BSF, 1942.

Students Eligible for Automatic Advancement

MICHIGAN COLLEGE OF MINING & TECHNOLOGY

Burkhardt, A. F.
Ciucci, L. J.
Ford, R. C.
Hanson, D. P.
Kepen, G. H.
Kopitsch, R. L.
Lewis, W. C.
Lundberg, J. F.
Marita, F. J.
Massie, R. M.
Puuri, C. R.
Rosek, W. T.
Ryc, J. A.
Theilen, R. R.
White, J. A.

MICHIGAN STATE UNIVERSITY

Baier, G. K.
Ekstrom, L. K.
Estola, J. D.
Kastner, R. E.
Lightfoot, B. E.
Mahn, C. A.
Manthy, R. S.
Moore, M. D.
Riddle, C. D.
Sanders, R. C.
Sibbald, J. H.
Stewart, J. L.

UNIVERSITY OF MICHIGAN

Bauer, R. G.
Boden, W. A.
Braidwood, J. C.
Burtis, J. J.
Fatzinger, C. W.
Finke, D. L.
Gregg, J. B.
Hansen, D. C.
Lehman, D. A.
Martin, R. P.
Mateer, B. T.
Nord, J. C.
Ohman, C. P.
Oliver, W. W.
Olmsted, E. W
Owston, P. W.
Romeril, A. B.
Smith, C. T.
Vosburgh, J. C.
Wheeland, H. A.

Member Grade

Fry, G. W., Supt., Isle Royal Nat Park, Houghton, Mich. (Reinstatement).

Irwin, A., Vice Pres., General Box Co., Detroit, Mich. Pa. State, BSF, 1938, Yale, MF, 1940 (Junior 1956).

Jordan, W. R., Wis. Cons. Dept., Madison, Wis. (Reinstatement).

Ramsey, R. A., Forester, Bur. of Indian Affairs, Keshena, Wis. Iowa State, BSF, 1950 (Junior 1956).

Ruppenthal, R. E., Forester, USFS, Cadillac, Mich. Mich. State, BSF, 1955 (Junior 1955).

Associate Grade

Sachs, I. B., Wood Tech., Forest Products Lab., Madison, Wis.

No Section

Corresponding Grade

Afghanzadah, M. A., Forester, Ministr of Agric., Kabul, Afghanistan.

Alim, A., Divisional Forest Officer, Conservator of Forests, Dacca, East Pakistan.

Aoki, Y., Director of Fukuoka Prefecture, Forest Expt. Station, Fukuoka City, Japan.

Sakaguchi, K., Chief, Gov. Forest Expt. Station, Nagano Pref., Japan.

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Forestry News

THE HIGHEST honor of the U. S. Department of Agriculture, its distinguished service award, was presented to the Forest Products Laboratory at its fiftieth birthday party in Madison, Wisconsin, June 2-4. Above, E. C. Betts, Jr., department personnel director, hands the award to Laboratory Director Edward G. Locke.

morning of June 3 in Memorial Union Theatre, Edward G. Locke, director of the laboratory, presided. Addresses on the subject of research were made by Conrad A. Elvehjem, president of the University of Wisconsin; Frederick K. Weyerhaeuser, chairman of the board of the Weyerhaeuser Company; Howard E. Whitaker, president of the American Paper and Pulp Association; W. E. Difford, executive vice president of the Douglas Fir Plywood Association; and Samuel Lenher, vice president of E. I. du Pont de Nemours & Co.

Hon. Gaylord Nelson, governor of Wisconsin, gave the principal address at the luncheon that followed. Introductory remarks were made by Stanton W. Mead, president of Consolidated Water Power and Paper Company.

Open house at the Laboratory and tours for the guests featured the afternoon of June 3. Several plaques and scrolls were presented to the laboratory by forest products associations.

First of its kind in the world, the laboratory was established as a unit of the U. S. Forest Service in co-

Forest Products Laboratory Holds Golden Anniversary

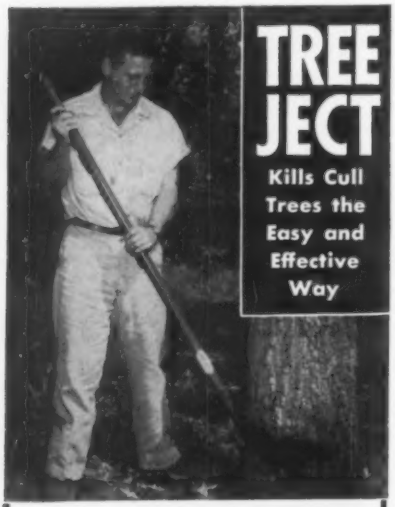
A three-day observance of the fiftieth anniversary of the Forest Products Laboratory at Madison, Wis., held June 2-4, was attended by nearly 500 friends and associates from other laboratories and experiment stations, universities and colleges, industrial and governmental agencies, professional and scientific societies, and six foreign nations. They joined with the laboratory's staff to commemorate the accomplishments and broad program of public service during the past half-century.

Opening the official ceremonies was a golden anniversary banquet held in the Memorial Union of the University of Wisconsin. George A. Garratt, dean of the Yale University School of Forestry, was toastmaster.

A citation was made to McGarvey Cline, first director of the laboratory, by the University of Wisconsin. A Distinguished Service Award was presented to the laboratory by the Department of Agriculture.

Following remarks by Richard E. McArdle, chief of the U. S. Forest Service, the address of the evening was made by Ervin L. Peterson, Assistant Secretary of Agriculture.

At the general assembly, held on the



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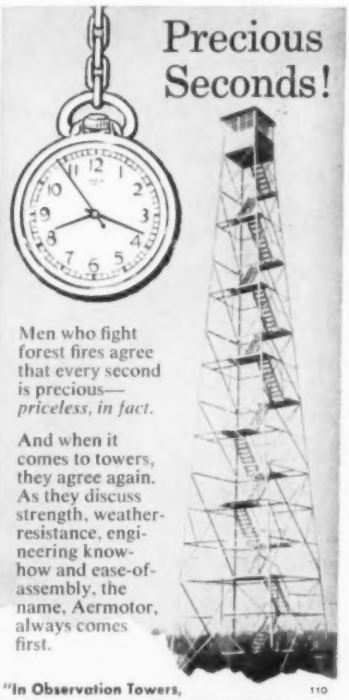

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operation with the University of Wisconsin on June 10, 1910, with 45 employees. Its present home, overlooking beautiful Lake Mendota, was occupied in 1932. It is still the federal government's only scientific laboratory with national responsibility for research in its field.

National Grasslands Established

By order of the Secretary of Agriculture 22 land utilization projects in 11 Great Plains and western states have been designated "National Grasslands" and are to be permanently held by the Department of Agriculture and administered by the Forest Service as part of the national forest system. The chief of the service is given authority to group and name these lands. They are to be administered to the fullest extent practicable for multiple use and sustained yield of all the products and services obtainable from them. Additionally, they are to be managed so as to maintain and improve soil and vegetative cover and promote the development of grassland agriculture in the areas of which they are a part. Regulations applicable to the national forests are adopted as the regulations to govern the use, occupancy, protection and administration of the "National Grasslands."

The lands involved include some 3.8 million acres acquired in the department's program of land utilization and land-use adjustment begun in the 1930's as an emergency measure and continued under Title III of the Bankhead-Jones Farm Tenant Act of 1937. The lands were managed and developed by the Soil Conservation Service from 1938 through 1953 and since then by the Forest Service. The majority of these lands are in the Great Plains areas that have been subject to wind and recurrent drought problems and are primarily unsuited to cultivation. They have in large measure been restored to grass or other suitable cover and are valuable for water production, streamflow regulation, production of forage for livestock, propagation of wildlife, and public recreation, including hunting and fishing.

In the past, administration of these lands has been handicapped by the uncertainly as to their future use and management. They have now been given permanent status. Present uses will be continued and strengthened. The Forest Service considers the lands to have material capacities for rendering additional public services and producing additional resources. It intends to fully develop these capacities under the multiple-use directive in the Order.

Administration of oil, gas, and mineral leases and permits on these lands will continue to be handled by the Department of the Interior.

States with national grasslands and the acreages involved are as follows:

North Dakota, 1,104,000 acres;
South Dakota, 866,927 acres;
Colorado, 626,765 acres;
Kansas, 106,585 acres;
Nebraska, 94,234 acres;
Wyoming, 573,386 acres;
Oklahoma, 46,211 acres;
Texas, 115,211 acres;
New Mexico, 133,103 acres;
Idaho, 49,770 acres;
Oregon, 105,925 acres.

13 Forest Service Men, 2 Units Honored

The Department of Agriculture on May 17 honored seven persons for distinguished service, 82 for superior service, and named for later presentation 13 Unit Awards.

One of the latter was for distinguished service and was subsequently presented to the Forest Products Laboratory.

Dr. Edward C. Crafts, assistant chief of the Forest Service, Washington, D. C., received one of the seven Distinguished Service Awards. He was cited "for leadership in guiding the formulation of forest-resource policies and legislation, for vision in developing forest conservation programs of

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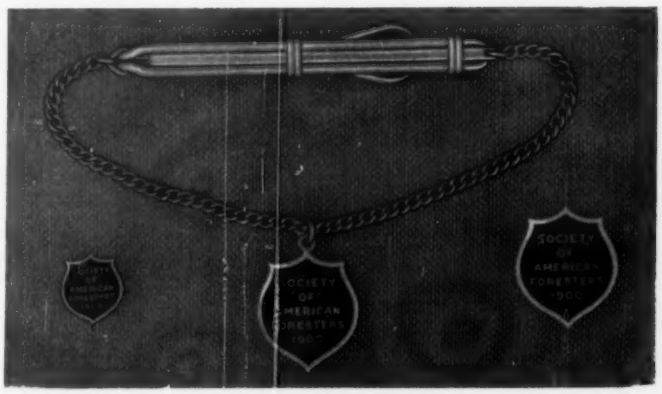

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national significance, and for achieving continuous performance to exceptionally high standards."

Forest Service personnel receiving Superior Service Awards were: Jack S. Barrows, Missoula, Mont.; Philip A. Briegleb, New Orleans, La.; Melvin A. Coonrod, Ogden, Utah; Anthony P. Dean, Washington, D. C.; Fredrick W. Grover, Washington, D. C.; Axel G. Lindh, Missoula, Mont. (recently transferred to the Washington office); Dr. Elbert L. Little, Jr., Washington, D. C.; Walter H. Lund, Portland, Ore.; Howard E. Marshall, Washington, D. C.; Virgil D. Moss, Spokane, Wash.; J. Herbert Stone, Portland, Ore.; and Herbert C. Storey, Washington, D. C.

The second Forest Service group honored, receiving a Unit Award, was the Hebgen Lake-Madison River Earthquake Rescue Unit, Bozeman, Dillon, and Missoula, Mont.

Multiple Use of National Forests Becomes Law

President Eisenhower on June 17 signed into law P. L. 86-517 directing that the national forests be administered for multiple use and sustained yield, which are defined in the law. It is considered to be a fundamental charter for national forest management and development, along with the 1897 Forest Administration Act.

The new law provides that the national forests shall be administered for outdoor recreation, range, timber, water, wildlife and fish but gives no statutory priority to one resource over another. The 1897 act specifically covered only timber and water, so that this is the first time all basic renewable resources have been given legislative recognition in a single statute.

Although multiple use and sustained yield have been the guiding principles of Forest Service administration for years, they are now given legal status.

Also, this is the first law to recognize wildernesses which are established in national forests by order of the Secretary of Agriculture. A USDA spokesman pointed out, however, that this is not a substitute for wilderness bills pending in Congress and which the department supports in principle.

The law specifically states that it does not affect the use of minerals in the national forests nor does it affect the responsibilities of the states with respect to fish and game. It provides protection against excessive advocacy of any single use of the national forests.

Forest Products Research Society Meets

The Forest Products Research Society's 14th annual meeting, and the first held in an international setting, drew 446 men and 140 ladies to Montreal, Canada, June 5-9. Although primarily from the United States and Canada, the group also included representatives of Australia, Germany, Finland, New Zealand, Belgium, and Japan.

The meeting included 19 technical sessions at which 67 papers or panel discussions were presented and various business meetings conducted to review and revise the Society's internal affairs.

The following executive officers were elected: president—R. H. Berry, Scott Lumber Co., Inc., Burney, Calif.; president-elect—D. K. Saunders, Westbrook, Maine; vice president—T. S. Veazey, Anaconda Co., Bonner, Mont. Past-president is Dr. E. S. Harrar, dean, School of Forestry, Duke University, Durham, N. C.

Dr. Harrar regretfully announced the resignation (effective Aug. 1) of Executive Secretary Frank J. Rovsek, Madison, Wis., and thanked him for his 10 years of efforts on behalf of the Society.

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TEXTBOOK OF DENDROLOGY. *Fourth Edition.* By William M. Harlow, *State University of New York College of Forestry;* and E. S. Harrar, *Duke University.* McGraw-Hill American Forestry Series. 561 pages, $9.50

FUNDAMENTALS OF FORESTRY ECONOMICS By William A. Duerr, *State University of New York College of Forestry, Syracuse University.* McGraw-Hill American Forestry Series. 576 pages, $9.50.

TEACHING SCIENCE THROUGH CONSERVATION By Martha E. Munzer, *The Conservation Foundation;* and Paul Brandwein, *Harcourt, Brace & Company.* 470 pages, $7.50.

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N. C. STATE COLLEGE DEDICATES NEW LABORATORY. The Brandon P. Hodges Wood Products Laboratory was dedicated at North Carolina State College Wednesday, May 25.

An executive board recommendation to raise the voting and associate dues in 1961 to $20.00 was approved by a majority of the voting members present at the annual business meeting. There was expressed a great need to raise the Society's operating revenue and improve its services. The proposal will be submitted to the membership at large for ratification by mail ballot.

Also presented and approved was a proposal to reorganize the Society's 14 subject matter Divisions into 11 Divisions, designated by generic titles and broken down into various products subdivisions.

Schools

National Plant Food Institute Provides Research Grants

Six grants for forest fertilization research in the South have been provided by the National Plant Food Institute, according to Robert L. Beacher, director of the Institute's Southern Region.

Scientists receiving financial support from the Institute are: Dr. T. E. Maki, North Carolina State College, Dr. Frank W. Woods, Duke University, Dr. Louis Metz, Southeastern Forest Experiment Station, U. S. Forest Service, George Sparrow, Tidewater Agricultural Experiment Station, USDA, and Dr. John Hamilton, University of Georgia.

A fund has been set aside for commercial nutrient analyses of plant tissues.

Dr. Beacher requested that inquiries concerning grants for research should be directed to the Institute's forestry consultant, Dr. L. C. Walker, University of Georgia, at Athens.

North Carolina Dedicates Wood Products Lab

North Carolina State College formally dedicated and named its new $250,000 Brandon P. Hodges Wood Products Laboratory Wednesday, May 25, in ceremonies attended by members of the Hodges family and wood industry and forestry leaders from throughout the Southeast.

The late Brandon P. Hodges was a key figure in the development of several college facilities and programs,

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Governor Luther H. Hodges, who made the address of dedication, declared that "the great forestry-related industries that have meant so much to us in the past and hold so much promise for the future have been a source of strength and stability in the progress of North Carolina and the South for more than three-quarters of a century."

The new wood products laboratory is the only research facility of its kind in the Southeast and is regarded as one of the outstanding laboratories of its type in the region. The laboratory is equipped with scientific and analytical equipment necessary for research in wood and wood products.

Basic objective of the laboratory, college officials said, will be a quest for knowledge about the properties and uses of wood.

A second objective will be to anticipate future needs of the wood-using industry and to conduct research designed to provide information required to meet industrial needs.

A third objective will be to develop the processes and techniques required to develop new uses for wood, improve upon old uses, and to develop techniques for converting wood into other useful products.

Dr. Richard J. Preston is dean of the College School of Forestry.

Retirement Of R. E. Trippensee

The June 30 retirement of Dr. R. E. Trippensee, professor of wildlife management at the University of Massachusetts since 1936, has been announced by the acting president, Shannon McCune.

Prof. Trippensee has rounded out nearly 25 years of service in the Department of Forestry and Wildlife Management and has seen the department grow from a handful of students to an undergraduate group of nearly 50 as well as 10 graduate students in this major field. He holds a bachelor degree from Michigan State University and a Master in Zoology and a Ph.D. in Wildlife Management from the University of Michigan. Besides his teaching duties at the University of Massachusetts, he was a special lecturer at the School of Forestry, Yale University.

Professor Trippensee has been prolific in the field of writing; his best known works include two books on wildlife management published by McGraw-Hill Book Company. These are now used as standard textbooks by students of wildlife management in nearly 50 colleges and universities. He has published numerous shorter technical articles on wildlife subjects.

Dr. Trippensee belongs to numerous scholastic and scientific fraternities and is a charter member and one of the founders of the Wildlife Society.

Short Course For Sawmill Operators

New and valuable tips on the operation of small sawmills are included in the fourth Small Sawmill Operators Short Course of The Pennsylvania State University to be held August 15-17, 1960, on the main campus of the university.

Included in the instruction will be discussions and demonstrations on sawing techniques, handling of problem logs, selection and maintenance of small mill equipment, layout of the mill and yard for efficient operation, use of the by-products of the mill,

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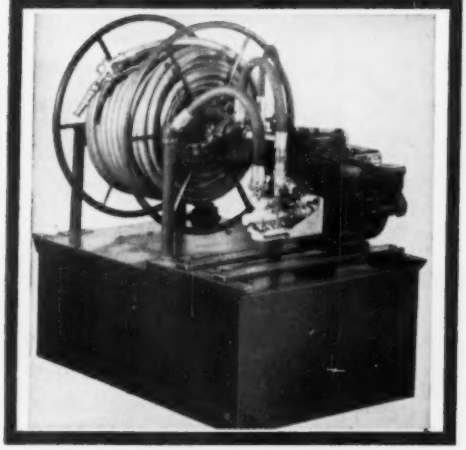

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Further information and application blanks can be secured from the Director of Short Courses, The Pennsylvania State University, College of Agriculture, University Park, Pa.

Professor T. Schantz-Hansen Retires

T. Schantz-Hansen, professor of forestry, retired from the University of Minnesota in June. He was director of the university's 3,700-acre Cloquet Forest Research Center and Itasca Forestry and Biological Station.

Schantz-Hansen has been on the university staff since 1919 and has been in charge of the School of Forestry's Cloquet Station since 1924. Under his leadership, the station has become one of the world's most noted forestry research centers.

In 1940, he was also named director of the Itasca Station.

He is a native of Cedar Falls, Iowa, attended Iowa State Teachers college, and later went to the University of Minnesota School of Forestry, where he received his B.S. degree in 1915.

After graduation he worked for 2 years as a forestry assistant for the U. S. Forest Service at Priest River, Idaho, and Flagstaff, Arizona. In 1917 he received his Master of Forestry and in 1935 he received his Ph.D. at Yale University.

He served in the U. S. Army in 1918, joined the university as a forestry instructor at the Cloquet station the next year and was placed in charge of the center in 1924. He is known around the world for his research in forest management, and for his fundamental studies on jack pine.

Schantz-Hansen has reported his works in more than 100 articles and papers and he has also co-authored the book *This Is Our Land* with E. G. Cheyney.

Pennsylvania Extension Forester Retires

Walter W. Simonds, chairman of forestry extension at the Pennsylvania State University, was granted retirement, effective June 30, as emeritus professor of forestry extension.

Mr. Simonds joined the Penn State staff July 15, 1936, as assistant professor in forestry extension. He was raised to associate professor in 1947 and to full professor in 1950, when he was given charge of the extension forestry program.

He initiated biennial conferences for Pennsylvania forest tree nurserymen, a boys' forestry training camp, and has developed a forestry program in 4-H Club work. He is a charter member and one of the founders of the Pennsylvania Christmas Tree Growers Association.

As extension forester, he developed an educational program relating to all phases of forestry in the state, includingn maple syrup production. He has been a member of the Pennsylvania Tree Farm Committee from the time of its origin, and is a member of the Pennsylvania State Chamber of Commerce committee on forest resources.

Simonds is the author of a number of extension circulars on forestry, all of which have had wide distribution. These have dealt with Christmas tree production, forest management, timber estimating, and forest tree nurseries. He received the bachelor of science degree in 1921 at Cornell University and the master of science degree a year later, both in silviculture.

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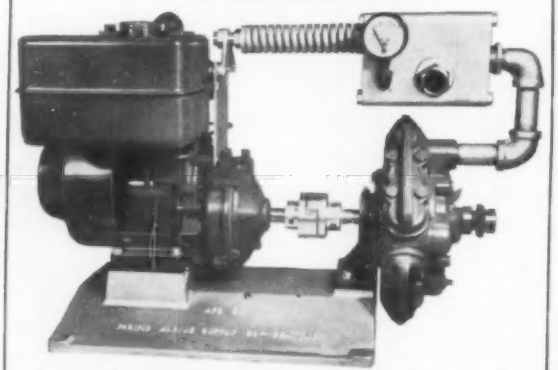

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C. O. Totman Joins Summers Fertilizer Co.

Announcement from Summers Fertilizer Company's home office in Baltimore, Md., advises that Brigadier General Clayton O. Totman, recently retired from the U.S. Marine Corps, has become associated with Summers' interests. As assistant vice president, his duties will be in the Company's various administrative departments including the development of a new Soil & Forest Conservation Division.

General Totman graduated from the University of Maine in 1935 with a B. S. degree in forestry. He was commissioned a second lieutenant, U.S. Marine Corps in 1935 and served continuously for twenty-five years until his retirement November 1, 1959, with the rank of brigadier general. His service covered a wide range of duty. His final assignment was special assistant to the Secretary of the Navy developing policy and management of the Navy's program for conservation of soils, water, forests, grasslands, fish and wildlife in its more than 750 installations throughout the world.

The Company plans to expand, under General Totman's direction, its activities in areas of fertilizer consumption with emphasis on forestry needs.

West Virginia Pulp and Paper Foresters Promoted

William Ernst, Jr., manager of West Virginia Pulp and Paper Company's Southern Woodlands Department in Summerville, S. C., has announced the promotion of W. G. Sheppard, previously district forester in Georgetown, to the position of assistant to the manager. Sheppard, who originally joined West Virginia in 1945, will locate in Summerville and assist in a staff capacity. He is a graduate of the University of Georgia.

The area formerly under Sheppard's jurisdiction will be broken down into three smaller districts, each with a district forester in charge. Foresters named are Donald L. McConaughy, a graduate of New York State College of Forestry who joined West Virginia in February 1957, Donald C. Meckert, New York State College of Forestry graduate who has been with the company since October 1957, and William R. Frazer, a graduate of Alabama Polytechnic Institute, with the company since June 1958.

Public

Interior Reports On Timber Cut

The Department of the Interior has issued a report on 1959 timber utilization showing the volume and value of forest products removed from lands administered by its various bureaus.

Timber harvested during the calendar year 1959 amounted to 1,768,382 M bd. ft., the highest cut recorded in the history of the Department's forestry operations. This was 37,241 M bd. ft. greater than the cut in the calendar year 1958.

The average value per M bd. ft. was $22.74, as contrasted to $21.78, an increase of $0.96.

In calendar year 1950 the Department cut was 1,116 M bd. ft. with an average value of $9.40.

Intermountain Station Director Honored

Reed W. Bailey, director of the Intermountain Forest and Range Experiment Station, U. S. Forest Service, received an honorary degree of Doctor of Science in June at the commencement exercises at Utah State University. The degree was awarded in recognition of Director Bailey's scientific studies in conservation, utilization, and control of water resources, and of his leadership in research on the causes and control of floods on mountain watersheds.

He recently completed 25 years as director of the Intermountain Station. Before joining the Forest Service he had been for several years professor of geology at Utah State University. He had studied there as an undergraduate, and holds Bachelor of Science and Master of Science degrees from the University of Chicago.

Kaniksu Supervisor Retires, Successor Named

Karl Klehm, supervisor of the Kaniksu National Forest at Sandpoint, Idaho, retired on July 31, and was succeeded by John D. Beebe, according to an announcement by Acting Regional Forester W. W. Dresskell, U. S. Forest Service, Missoula, Mont.

Mr. Klehm has served as supervisor of the Kaniksu National Forest since July 1952, and was previously supervisor of the Coeur d'Alene. His retirement marks a career of 41 years with the Forest Service, his first assignment having been with the Carson National Forest in New Mexico in 1918. He served for ten years as supervisor of the Kootenai National Forest, Libby, Mont.

John Beebe goes to his new post from the Division of State and Private Forestry in the regional office as head of the section of state cooperation. Prior to his assignment in 1957 to the regional office he served as timber staff officer and assistant supervisor of the Sequoia National Forest in California. Following his graduation from the University of California in 1937 with a B. S. in forestry, he served with the Northeast Timber Salvage Administration in New Hampshire and thereafter in various capacities on several western forests.

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Life Begins at SIXTY

The age of sixty, in the life of an organization, is more a mark of a vigorous, forceful, dynamic maturity than evidence of evening shadows. This is certainly the case with the Society of American Foresters which in 1960 observes its Diamond Jubilee — the sixtieth anniversary of its founding.

Never has the Society of American Foresters been stronger in numbers, more positive in sense of direction, more respected as a profession. The future bestirs real optimism. All the portents of a greater role are there — economic and social forces, the law of supply and demand, the pressures of booming population, the urgent recognition of need for wise management of our natural resources.

There is strong evidence of much further growth in early prospect for the Society of American Foresters. It is quite within reality to anticipate a doubling, within a few years, of the present membership of nearly 14,000.

In the retrospect of sixty years it may at times be difficult to recall in full clarity that the Society of today is the matured concept of seven young men — only one of whom was over thirty years old at the time — who sat down in a small room in Washington, D. C., in November, 1900, to found a professional organization for which they envisioned a need. They laid a splendid foundation.

Today, at a vigorous sixty, the time is appropriate for the Society of American Foresters to look back to note the distance and direction traveled and to look ahead to chart the future. This the Society will do in the October issue of the JOURNAL OF FORESTRY, its own nationally circulated professional magazine. Truly, it will be a Diamond Jubilee edition, an editorial compilation which every thoughtful member will review with keen interest and preserve with the justifiable pride that he is a part of it.

SOCIETY OF AMERICAN FORESTERS 1900

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CHARLES A. CONNAUGHTON, President
Society of American Foresters

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Grants Announced For Research To Be Done For USDA In Poland

Seven grants for research to be done at Polish scientific institutions for the U. S. Department of Agriculture have been announced. Three are for crop studies, three for research on forest problems, and one for a study aimed at control of a worm parasite of livestock.

USDA's foreign research, conducted by the foreign research and technical programs division of the Department's Agricultural Research Service, is paid for with foreign currencies accruing to the United States from the sale of surplus agricultural commodities under Public Law 480 (the Agricultural Trade Development and Assistance Act of 1954).

The forest research projects, to be carried on by the Forest Research Institute at Warsaw, are as follows: 1,019,100 Zlotys ($18,530) for a five-year investigation of the disease and insect susceptibility of North American tree species planted in the principal Polish climatic zones; 2,033,050 Zlotys ($36,965) for five-year investigations aimed at developing biological and chemical controls for insects of pine trees; and 775,175 Zlotys ($14,094) for a five-year study of the influence of soil moisture levels and rainfall on the growth of Scotch pine and spruce trees.

Drooz Joins Southeastern Station

Arnold T. Drooz has joined the staff of the Southeastern Forest Experiment Station, according to Joseph F. Pechanec, station director. Drooz, an entomologist, will head the Survey Unit of the Division of Forest Insect Research.

Drooz is a veteran of three years with the U. S. Air Force and holds a B.S. in forestry and an M.S. in entomology from New York State College of Forestry at Syracuse University. He was employed for four years by the Bureau of Entomology and Plant Quarantine and served in Maryland, Connecticut, and Wisconsin. In 1953 he was transferred to the U. S. Forest Service and was attached to the Lake States Station for four years.

Prior to joining the Southeastern Station, Drooz was employed by the Pennsylvania Department of Forests and Waters, where he supervised insect and disease detection on state forest lands.

ROBERT A. CAMPBELL

Research Foresters To New Assignments

Robert A. Campbell, formerly in charge of the Asheville Research Center, has a new assignment with the U. S. Forest Service as regional project leader of Southern Pine Log and Tree Grade Studies. His place as leader of mountain hardwood research and of Bent Creek Experimental Forest is being taken by George A. James.

After graduating from Michigan State College, Campbell started work with the U. S. Forest Service in 1933. He worked as forester for TVA 10 years, and joined the Southeastern Station in 1945. Campbell's work will include the demonstration of log and tree grades.

Mr. James is a graduate of University of Michigan, with a Master of Forestry from the University of California. Following 6 years with the Army he has been with the Forest Service for the past 12 years in Oregon and Alaska.

GEORGE A. JAMES

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Lane To Portland Post

Paul H. Lane, timber utilization specialist at the Wausau, Wis., Forest Research Center, has received a promotion and transfer to the Pacific Northwest Forest and Range Experiment Station at Portland, Ore.

The Wausau Center is a field unit of the Lake States Forest Experiment Station, U. S. Forest Service.

Lane will be responsible for the research needed to develop newer and better methods for determining the quality and value of standing timber in Douglas-fir and associated species. His first task will be coordinating Forest Service research under the National Log and Tree-Grade Project in these species.

Lane is a graduate of Purdue University. He began his career in the U. S. Forest Service on the Nicolet National Forest in 1935 and during World War II served in the U. S. Navy.

Research Center Laboratory Dedicated

An office and laboratory building to house the Grand Rapids Research Center, a field unit of the Lake States Forest Experiment Station, was dedicated on June 6. The new laboratory is located on the campus of the North Central School of Agriculture, a branch of the University of Minnesota at Grand Rapids.

More than 300 persons were present at the dedication ceremonies, of which Zigmond Sasada, leader of the research center, was master of ceremonies. Speakers included, among others, Forest Service Chief McArdle and Clarence Prout, deputy commissioner of the Minnesota Department of Conservation.

Researcher To Georgia Post

Wallace L. Fons, a member of the forest fire research staff at the Pacific Southwest Forest and Range Experiment Station in Berkeley, Calif., since 1933, has been promoted and transferred to the new Southern Forest Fire Laboratory at Macon, Ga.

At Macon Fons will serve as chief investigator in basic research on free-burning fires in solid fuels.

Fons is an engineering graduate of the University of California (B.S. 1930; M.S. 1940). He is an Associate Member of the SAF and a member of the Fire Research Conference for the Committee on Fire Research of the National Academy of Sciences-National Research Council.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Positions Available

Teaching-research position in wood products in accredited forestry school in Midwest University. Teaching during one semester only in wood technology, and seasoning and preservation. Full-time research during one semester and summer. Appointment probably as assistant professor, but rank and salary commensurate with training and experience.
Box F, Journal of Forestry, Mills Building, Washington 6, D. C.

Lassen Junior College has announced a vacancy for an Instructor of Forestry to be filled by September 1. Starting salary range for a man with masters degree from $5300-$6100 for academic year (9 months). Experience in general forestry work with emphasis on aerial photography is desired.
Address application to Director, Lassen Junior College, Susanville, Calif.

Positions Wanted

Forester, B.S.F., New York State College of Forestry, 1957. Age 25, married, one child. Three year tour of duty with Military Intelligence in Europe complete October 1960. Desire to begin forestry career with consulting firm or private industry, preferably one engaged in tropical forestry operations. Experience: 1 summer's work with United Forest Service in Oregon; 2 summers with private tree trimming company in large Northeastern city.
Box C, Journal of Forestry, Mills Building, Washington 6, D. C.

Forest Management, B.S. 1941, Iowa State. Age 42, married, 2 children. Twenty years experience including all phases of forest management, research and development and with USAAF Service as pilot including European tour of duty. Want opportunity to obtain Doctorate degree through research or lecturing grant.
Box D, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., 1949, N. Y. State Univ. College of Forestry. Age 34, married, family, veteran. Experience: 10 years on large university property in Northeast involving all phases of forest management and administration; timber sale planning and administration, silviculture, TSI in northern hwd. types, bldg. and heavy equipment maint., fire control, purchasing and cost accounting, some research in silviculture. Active in community affairs. Desire position as property forester or manager on large private or public forest.
Box E, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S.F., West Va. University 1951, Management curriculum. Age 33, married, 3 children. Experience: 7½ yrs. timber and land management in Florida and Georgia, supervising and performing marking, cruising, fire suppression and pre-supp. work; mechanical site prep.; hardwood control; road and boundary line maint., timber sales; tax returns; reforestation; surveying and mapping, aerial photo interpretation; fire damage appraisal; administrative and public relations; also one year pulpwood and sawtimber procurement Georgia and Virginia. Prefer timber management in South.
Box G, Journal of Forestry, Mills Building, Washington 6, D. C.

B.S.F., Michigan State University 1957. Age 26, married, one child. Undergrad special problems course in Maple syrup production. One year United States Forest Service. Desire position in private industry. Willing to relocate.
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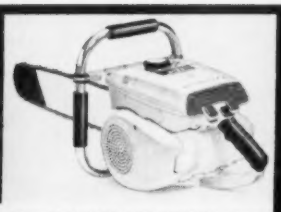

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